Nokia Customer Care

Service Manual

RM-348; RM-349; RM-350 (Nokia N79; L3&4)

Mobile Terminal

Part No: (Issue 2)

COMPANY CONFIDENTIAL

NOKIA
Care

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Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	09/2008	A. Salo	
Issue 2	09/2008	A. Salo	New chapters added: • **Service information differences between RM-349 and RM-348** • **Service information differences between RM-350 and RM-348**

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IMPORTANT

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Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

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ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

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Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

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Company policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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- Latest Amendment Number (if applicable)
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Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Li-Ion batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

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Nokia N79; L3&4 Service Manual Structure

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2 Service Tools and Service Concepts
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4 RF Troubleshooting
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7 FMTx 2.0 Troubleshooting
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10 Service information differences between RM-350 and RM-348
Glossary

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1 — General Information

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Product selection

The RM-348 (Nokia N79-1) is a dual mode handportable multimedia computer, supporting GSM/ GPRS/ EGPRS 850/900/1800/1900, with WCDMA 900/2100 HSDPA and WLAN.

The device is a 3GPP Release 5 terminal supporting WCDMA/HSDPA, EGPRS and GPRS data bearers. For WCDMA/ HSDPA the maximum bit rate is up to 3.6 Mbps for downlink and 384 kbps for uplink with simultaneous CS speech or CS video (max. 64 kbps).

For 2G and 2.5G networks the device is a Class A EGPRS DTM MSC 11 which means a maximum download speed of up to 296kbit/s with EGPRS, and up to 107kbit/s with GPRS.

According to GSM standard 05.05 it responds to class 4 (max. 2W) in GSM 850 and EGSM 900 class 1 (1W) in DCS 1800 and class 1 in PCS 1900. The device supports EGPRS (EDGE) class B as well as Bluetooth 2.0 EDR standard.

The device supports two way video calls with two integrated cameras, one on the front and one on the back.

The device is an MMS (Multimedia Messaging Service) enabled multimedia computer with a large 2.4'' QVGA (240 x 320 pixels) TFT colour display capable of displaying 16 million colours and an integrated 5 Megapixel auto focus camera. The MMS implementation follows the OMA MMS standard release 1.2. The Browser is a highly advanced internet browser also capable of viewing operator domain XHTML Mobile Profile (MP) content.

The device uses Symbian 9.3 operating system and supports MIDP Java 2.0 & CLDC1.1, providing a good platform for compelling 3rd party applications.

Figure 1 View of RM-348

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Product features and sales package

Imaging

Main camera:

- Sensor: 5 megapixel
- Carl Zeiss Optics: Tessar™ lens
- F number/Aperture: F2.8
- Focal length: 4.6 mm
  35 mm (35 mm equivalent)
- Focus range: 10 cm ~ infinity
- Macro focus distance: 10-50 cm
- Shutter speed: Mechanical shutter 1/1000~1/4 s

Secondary camera:

- Sensor: CIF (352 x 288 pixels)
- F number/Aperture: F2.8
- Focal length: 43 mm (35mm equivalent)
- Focus range: 10 cm ~ infinity

Video:

- Video resolution: QCIF at 15 fps
- Audio recording: AAC (AMR for MMS)
- Video stabilization
- Video clip length: 60 min
- Video file format: .mp4 (default), .3gp (for MMS)
- White balance: automatic, sunny, cloudy, incandescent, fluorescent
- Scene: Auto, Night
- Colour tone: normal, sepia, B&W, vivid, negative
- Zoom (digital): up to 8x

Photo:

- Still image resolutions: up to 3.2 megapixel: 2048 x 1536
- Still image file format: JPEG/EXIF
- Auto focus
- Auto exposure: center weighted AE
- Image orientation: automatic
- Exposure compensation: +2 ~ -2EV at 0.5 step
- White balance: automatic, sunny, cloudy, incandescent, fluorescent
- Scene: auto, sports, portrait, close-up, landscape, night, user defined
- Colour tone: normal, sepia, B&W, vivid, negative
- Zoom (digital): up to 20x

Other camera features:

- LED flash and recording indicator

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- Front camera, CIF (352 x 288) sensor

Edit

- On device Photo editor and Video editor (manual & automatic)

View

- 2.4" QVGA (240 x 320 pixels) 16 million colour TFT display with wide viewing angle and ambient light detector - used to optimize display and keypad backlight brightness and power consumption
- Slideshow from Gallery

Share

- Nokia XpressShare - share effortlessly from Gallery or after capture via Email, Bluetooth, MMS or IrDA
- Direct connection to TV via cable or WLAN (UPnP)
- Video call and video sharing support. (WCDMA services)
- Online Album : Image/Video uploading from Gallery

Print

- Nokia XpressPrint – direct printing via USB (PictBridge), Bluetooth (BPP), and WLAN (UPnP), from memory card or via online printing

Store

- Nokia XpressTransfer – easy to transfer and organize photos and video between your device and a compatible PC
- Nokia Lifeblog (mobile & PC)

Music

- Digital music player: supports MP3/ AAC/ AAC+/ eAAC+/ WMA with playlists, equalizer and album art.
- Synchronise music with Microsoft Windows Media Player 10 & 11
- One click CD ripping, converting and transferring music to your device using Nokia Music Manager
- Stereo FM radio (87.5-108MHz /76-90MHz) with Visual Radio™ support
- Stereo speakers
- Integrated FM transmitter (88.1 – 107.9 MHz)
- Integrated handsfree speaker
- Nokia Stereo Headset (HS-45), in-box

Media

- Full-screen video playback to view downloaded, streamed or recorded video clips
- Supported video formats: MPEG-4 , H.264/AVC, H.263/3GPP, RealVideo 8/9/10

Productivity

Messaging:

- E-mail (SMTP, IMAP4, POP3), MMS, SMS

Office applications:

- Viewing of email attachments – .doc, .xls, .ppt, . pdf

PIM:

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- Contacts, calendar, to-do, notes, recorder, calculator, clock, converter

Synchronization:

- Local/Remote (using SyncML)
  - Data: Calendar, Contacts, To-do, Notes, E-mail
  - PC Applications: Microsoft Outlook (98, 2000, 2002, 2003), Outlook Express, Lotus Organizer (5.0, 6.0), Lotus Notes (5.0, 6.0)

Call management:

- Call logs, speed dial, voice dialling (with SIND) and voice commands
- Nokia Push to Talk (PoC)

Connectivity

- WLAN - IEEE802.11 g/b with UPnP support
- Micro USB interface with USB 2.0 high speed
- Bluetooth wireless technology 2.0 + EDR
- Nokia 3.5 mm AV connector

Add-on software framework

- Symbian 9.3 OS
- Nokia Series 60, 3rd edition, feature pack 2
- Java: MIDP2.0
- C++ and Java SDKs

Additional technical specifications

- Vibrating alert
- 3GPP Rel 5 compliant
- Speech codecs supported in WCDMA: AMR
- Speech codecs supported in GSM: FR AMR/HR AMR/EFR/FR/HR
- WCDMA HSDPA 2100 MHz with simultaneous voice and packet data (PS max speed DL/UL= 3.6Mbps/ 384kbps, CS max speed 64kbps)
- Dual Transfer Mode (DTM) support for simultaneous voice and packet data connection in GSM/EDGE networks. Simple class A, multi slot class 11, max speed DL/UL: 118.4/118.4kbits/s
- EGPRS class B, multi slot class 32, (5 Rx + 3 Tx / Max Sum 6), max speed DL/UL= 296 / 177.6 kbits/s
- GPRS class B, multi slot class 32 (5 Rx + 3 Tx / Max Sum 6), max speed DL/UL= 107 / 64.2 kbits/s
- GPS

Sales package

- Transceiver RM-348
- Charger (AC-5)
- Battery (BL-6F)
- Music headset (HS-45/AD-45; HS-45/AD-43; HS-45/AD-54)
- Connectivity cable (CA-101)

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Mobile enhancements

Table 1 Audio

Enhancement	Type
Music headset	HS-45 with AD-45 3.5mm stereo plug
	HS-45 with AD-43 3.5mm stereo plug
	HS-45 with AD-54 stereo plug
Basic headset	HS-41
Stereo headset	HS-48
Wireless headset	HS-26W
	HS-36W
Bluetooth headset	BH-100
	MONO BH-200
	BH-201
	BH-202
	BH-203
	BH-205
	BH-206
	BH-207
	BH-300
	BH-301
	BH-302
	BH-303
	STEREO BH-501
	BH-600
	STEREO BH-601
	BH-602
	BH-700
	BH-701
	BH-800
	BH-801
	BH-802
	BH-900
	BH-902
	STEREO BH-903
Wireless stereo gateway	AD-42W

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Enhancement	Type
Music headphone	HS-61
Advanced headphone	HS-62
Music speaker	MD-3
Mini speaker	MD-4

Table 2 Car

Enhancement	Type
Nokia Universal Holder	CR-99
Mobile charger	DC-4
Wireless plug-in car handsfree	HF-6W
	HF-33W
	HF-34W
	HF-35W
Car kit	Nokia 616
Multimedia car kit	CK-20W

Table 3 Data

Enhancement	Type
Connectivity cable	CA-101
Video connectivity cable	CA-75U
MicroSD card	128MB upwards

Table 4 GPS

Enhancement	Type
Wireless GPS module	LD-3W
Navigation pack	LD-2

Table 5 Messaging

Enhancement	Type
Digital pen	SU-27W
Wireless keyboard	SU-8W

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Table 6 Power

Enhancement	Type
Battery 1200mAh Li-ion	BL-6F
Travel charger	AC-4
	AC-5
Charger adapter	CA-44

Table 7 Carrying

Enhancement	Type
Universal carrying case	

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm^3)
Transceiver with BL-6F 1200mAh li-ion battery back	110 x 49 x 14.9	~100.8	76.5

Main RF characteristics for GSM850/900/1800/1900 and WCDMA VIII (900) and WCDMA I (2100) phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA VIII (900) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA VIII (900): 925- 960 MHz
	WCDMA I (2100): 2110 - 2170 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA VIII (900): 880 - 915 MHz
	WCDMA I (2100): 1920 - 1980 MHz

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Parameter	Unit
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA VIII (900): -50 ... +24 dBm/0.01µW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01µW ... 251.2mW
EDGE output power	EDGE850: +5 ... +29dBm/3.2mW ... 794mW
	EDGE900: +5 ... +29dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA VIII (900): 152
	WCDMA I (2100): 277
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA VIII (900): 75
	WCDMA I (2100): 75

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-6F	1200	up to 190 mins (WCDMA) & 260 mins (GSM)	up to 320 hrs (WCDMA) & 320 hrs (GSM)

Charging times

AC-5
1h 30 min

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Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15 ºC ... +55 ºC	Specifications fulfilled
Reduced performance	55 ºC ... +70 ºC	Operational only for short periods
Intermittent or no operation	-40 ºC ... -15 ºC and +70 ºC ... +85ºC	Operation not guaranteed but an attempt to operate will not damage the phone
No operation or storage	<-40 ºC and >+85 ºC	No storage. An attempt to operate may cause permanent damage
Charging allowed	-15 ºC ... +55 ºC	
Long term storage conditions	0 ºC ... +85 ºC	
Humidity and water resistance		Relative humidity range is 5 to 95%. Condensed or dripping water may cause intermittent malfunctions. Protection against dripping water has to be implemented in (enclosure) mechanics. Continuous dampness will cause permanent damage to the module.

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2 — Service Tools and Service Concepts

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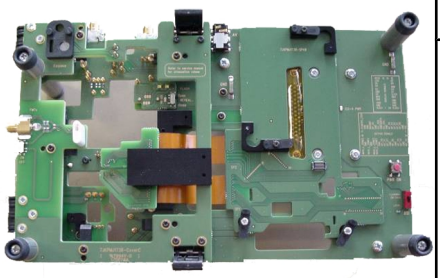
Service tools

Product specific tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-348; RM-349; RM-350. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2">
</td><td>FS-84</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">• FS-84 is equipped with a clip interlock system
• provides standardised interface towards Control Unit
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2">  </td><td>MJ-173</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-173 is meant for component level troubleshooting.
The jig includes RF interface for Bluetooth, WLAN and GPS. In addition, it has the following features:
• Provides mechanical interface with the engine module
• Provides galvanic connection to all needed test pads in module
• Multiplexing between USB and FBUS media, controlled by Vusb
• Duplicated SIM connector
• Connector for control unit
• Access for Audio-, MMC, and USB connectors</td></tr>
<tr><td rowspan="2"></td><td></td><td>Spare locking part for FS-84</td><td></td></tr>
<tr><td colspan="3">Spare part for FS-84.</td></tr>
<tr><td rowspan="2"> </td><td>SS-162</td><td>Navi key pressing tool</td><td></td></tr>
<tr><td colspan="3">SS-162 is used to bond the Navi key to the UI module when reassembling the device with the new UI module.
Note: To ensure proper bonding, pressure needs to be applied at least 3 seconds and assembly should be always verified by using Phoenix keypad test.</td></tr>
</table>

General tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-348; RM-349; RM-350. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

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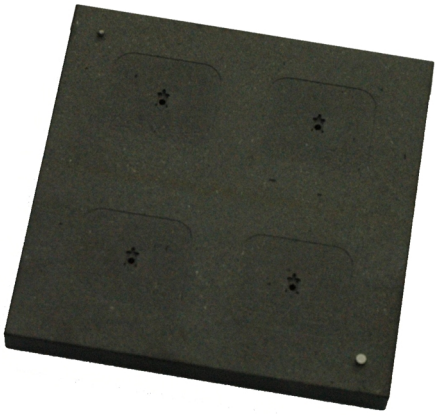
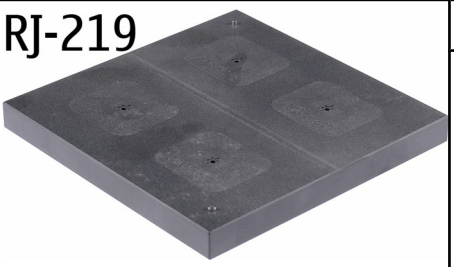
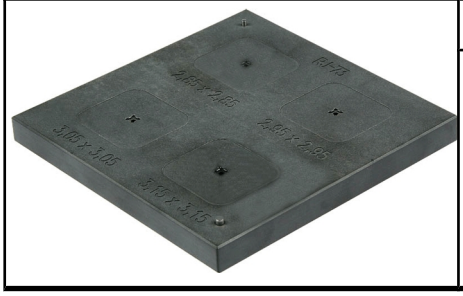
	RJ-166	Rework jig	
	RJ-166 is a jig used when servicing the accelerometer (N6501). It is used together with the ST-53 stencil.		
	RJ-209	Rework jig	
	RJ-209 is used as a rework jig for the WLAN 4.0 module This stencil takes the WLAN 4.0 module for spreading soldering paste onto the component. This must be used together with the ST-64 rework stencil.		
RJ-219 	RJ-219	Rework jig	
	RJ-219 is a jig used for soldering and as a rework jig for the FM transmitter chip. It is used together with the ST-69 stencil.		
RJ-230 	RJ-230	Soldering jig	
	The jig is used for soldering and as a rework jig for the system module. It is made of lead-free rework compatible material.		
	RJ-73	Rework jig	
	RJ-73 is a rework jig used when servicing the LED flash driver module (N1007). It is used together with rework stencil ST-29.		

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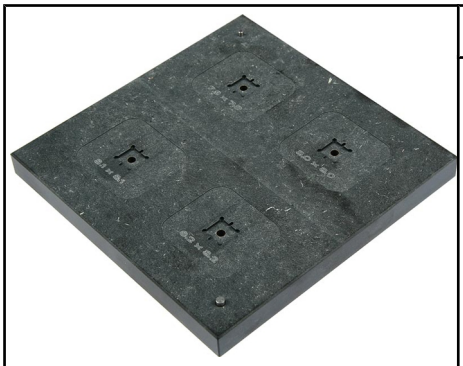
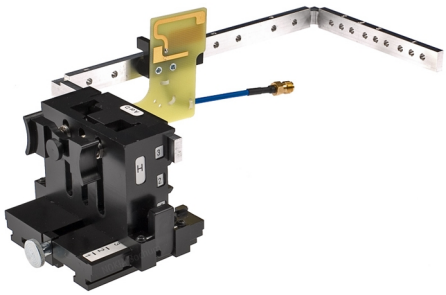


RJ-93	Rework jig	

RJ-93 is a rework jig used when servicing the PW AMP module (N7520). It is used together with rework stencil ST-40.



SA-131	RF coupler	

SA-131 is a generic device for GPS testing. It is used together with SS-62.

SA-136

SA-136	RF coupler	

SA-136 is an RF coupler for WCDMA and GSM RF testing. It is used together with SS-46 and SS-62.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-136:

Frequency	Att. (dB)
GSM850 TX	Low: 4,7 Mid: 4,2 High: 4,1
GSM850 RX	Low: 3,9 Mid: 3,8 High: 3,7
GSM900 TX	Low: 3,9 Mid: 3,8 High: 3,9
GSM900 RX	Low: 4,1 Mid: 4,9 High: 5,9
GSM1800 TX	Low: 4,5 Mid: 4,4 High: 4,5
GSM1800 RX	Low: 4,6 Mid: 4,8 High: 5,2
GSM1900 TX	Low: 5,0 Mid: 5,2 High: 5,2
GSM1900 RX	Low: 5,0 Mid: 4,7 High: 4,5
WCDMA850 TX	Low: 4,5 Mid: 4,2 High: 4,1
WCDMA850 RX	Low: 3,9 Mid: 3,9 High: 3,8
WCDMA1920 TX	Low: 5,1 Mid: 4,8 High: 4,6
WCDMA1920 RX	Low: 5,1 Mid: 5,0 High: 4,9

SS-100

SS-100	Camera removal tool	

The camera removal tool SS-100 is used to remove/attach a camera module from/to the camera socket of the phone PWB.

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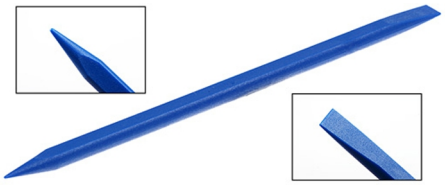
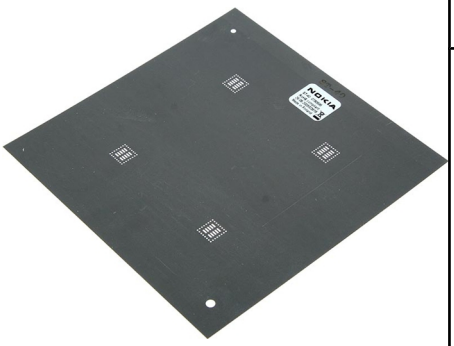
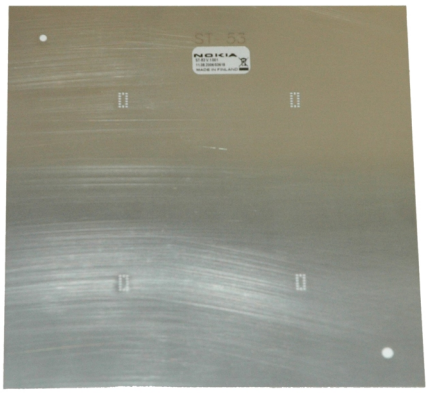
	SS-184	Window release tool	
	SS-184 is used for removing sub LCD window assy without disassembling the phone.		
	SS-93	Blue stick tool	
	SS-93 is used for general disassembly and assembly tasks.		
	ST-29	rework stencil	
	This stencil is to be used together with RJ-73.		
	ST-40	Rework stencil	
	ST-40 is a rework stencil and used with RJ-93.		
	ST-53	Rework stencil	
	ST-53 is a rework stencil used when servicing the accelerometer (N6501). It is used together with the rework jig RJ-166.		

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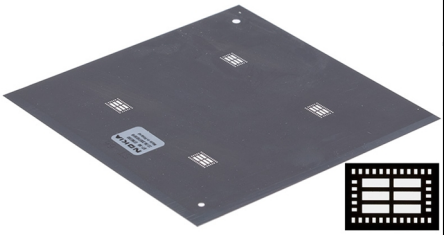
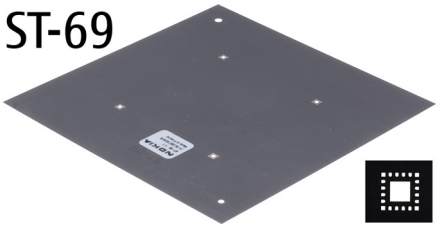
	ST-64	Rework stencil	
	ST-64 is the stencil used during rework of the WLAN 4.0 module. It must be used together with the RJ-209 rework jig.		
ST-69 	ST-69	Rework stencil	
	ST-69 is a rework stencil used with RJ-219.		

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-348; RM-349; RM-350. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

CA-101 100cm	CA-101	Micro USB cable	
	The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.		
	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.		

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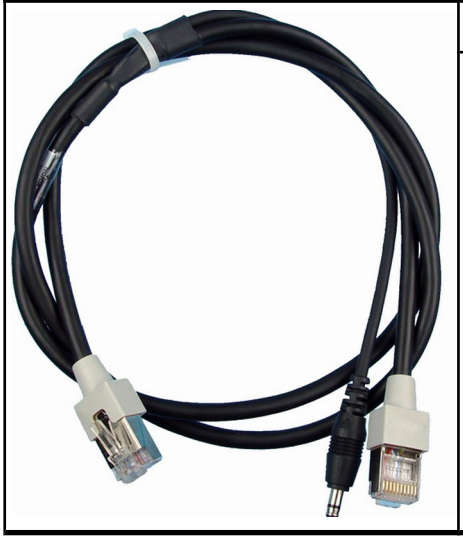
	CA-35S	Power cable	
	CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.		
	PCS-1	Power cable	
	The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.		
	XCS-1	Service cable	
	The XCS-1 service cable is used to connect FLS-4S to the POS flash adapter for supplying a controlled operating voltage and data connection.		

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	XCS-4	Modular cable	
	XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.		
	XRS-6	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector approximately 610 mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WLAN: 0.6+-0.1dB		

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Service concepts

POS (Point of Sale) flash concept

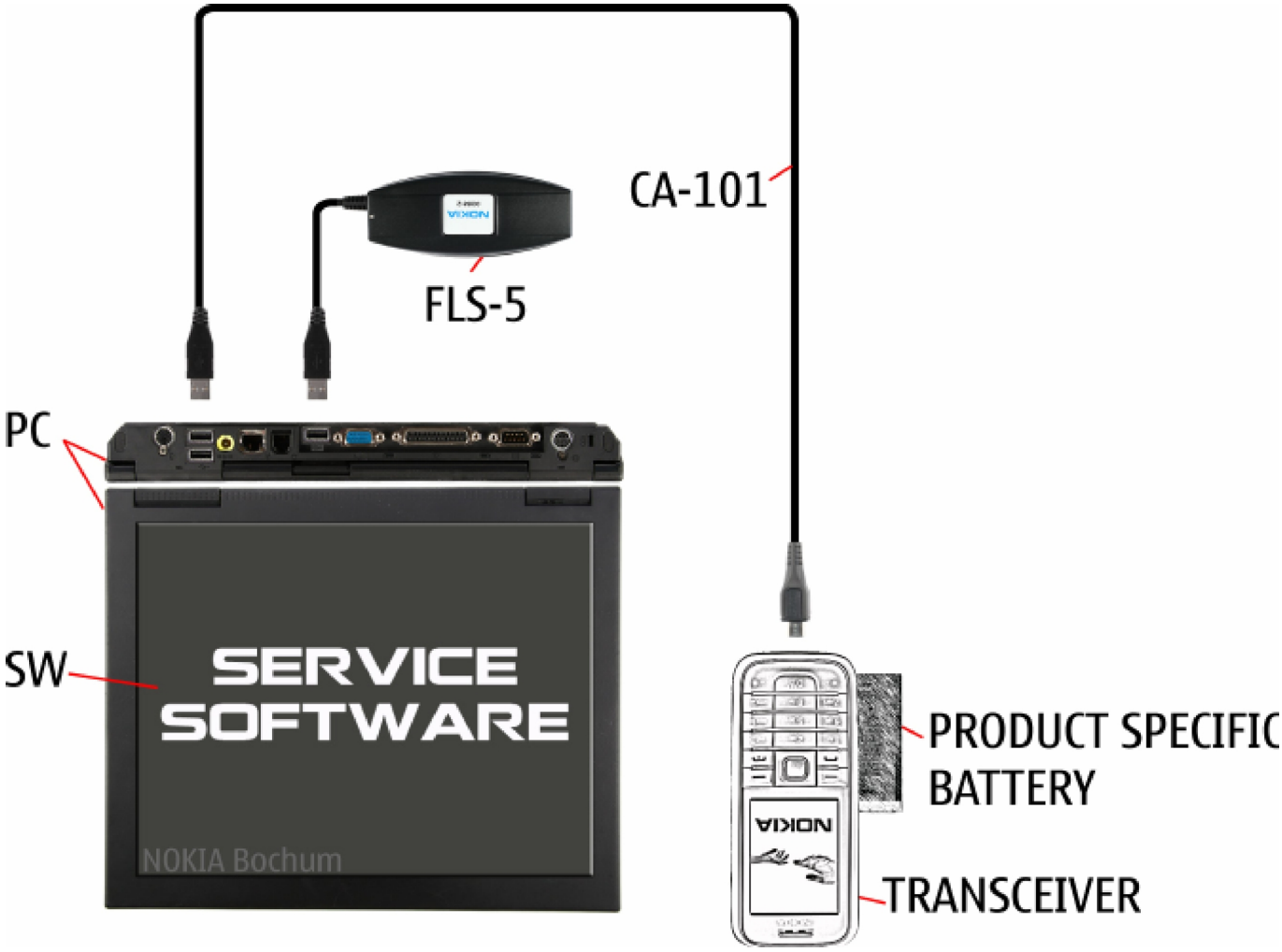

Figure 2 POS flash concept

Type	Description
Product specific tools	
BL-6F	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	USB connectivity cable

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Flash concept with FPS-10

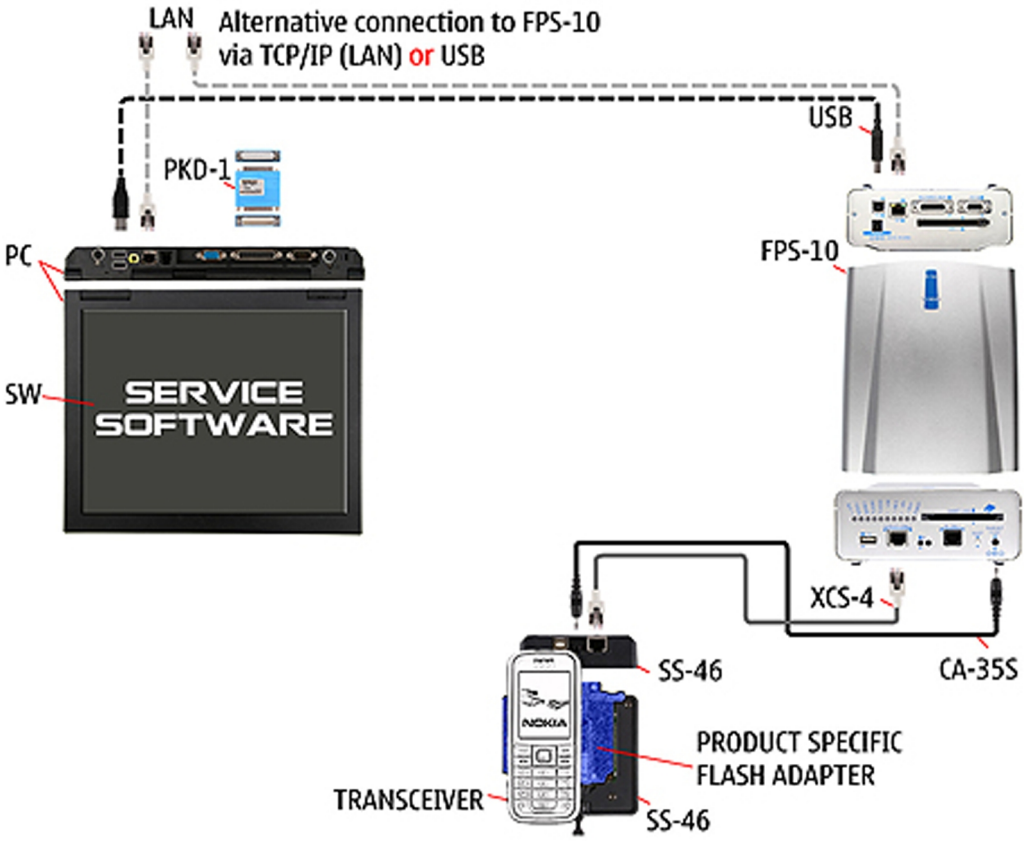

Figure 3 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-84	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

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CU-4 flash concept with FPS-10

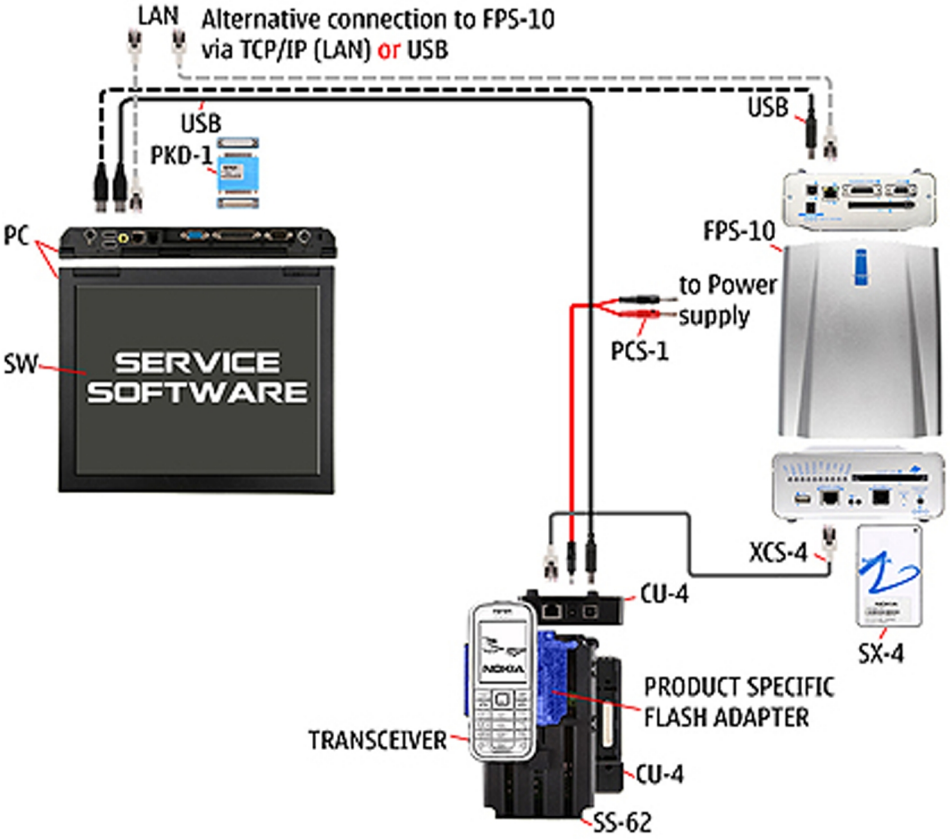

Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-84	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

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Flash concept with FPS-10 and SB-6

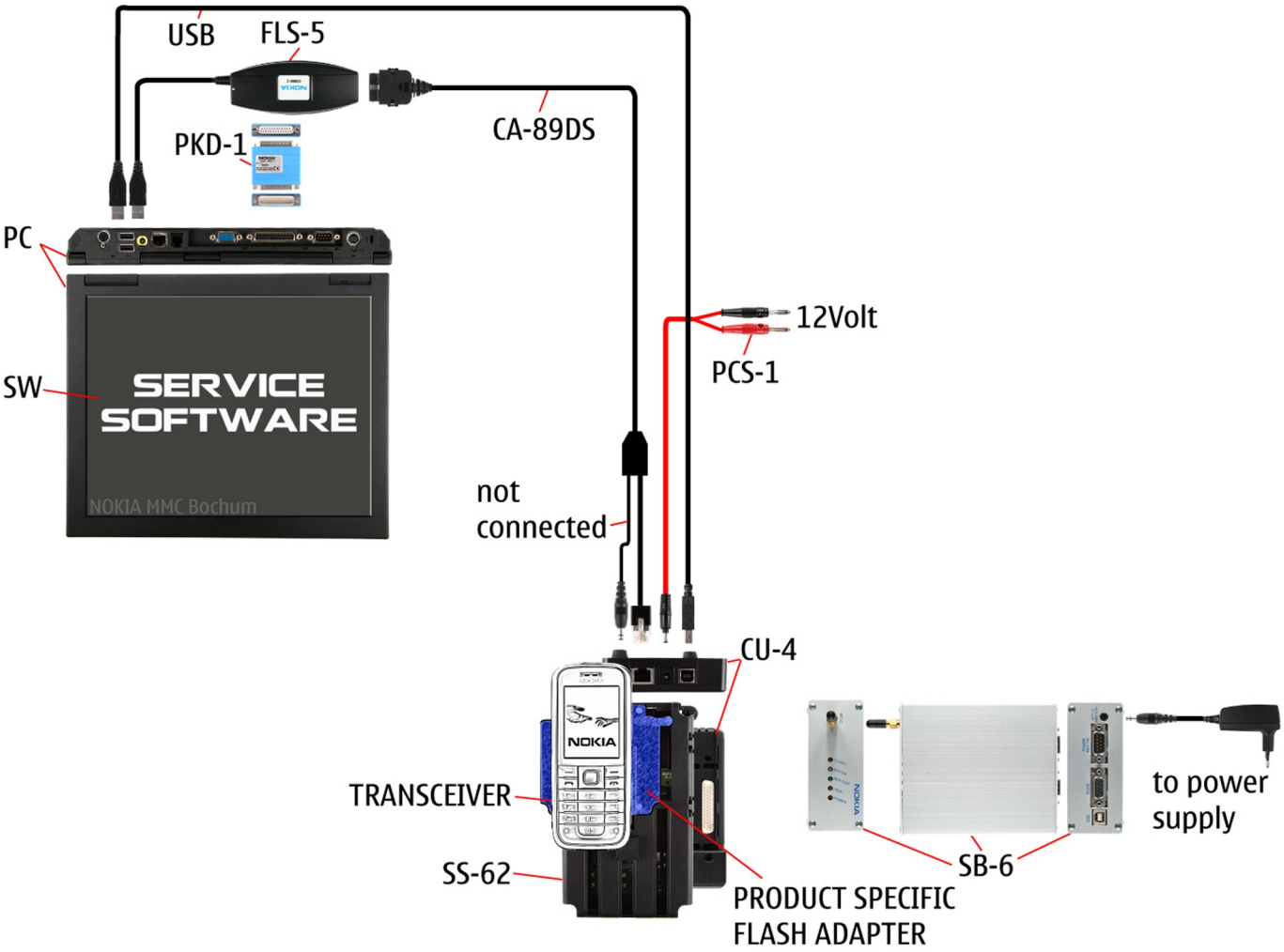

Figure 5 Flash concept with FPS-10 and SB-6

Type	Description
Product specific tools	
FS-84	Flash adapter
Other tools	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
SB-6	Bluetooth test and interface box
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable

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Type	Description
	USB cable

Flash concept with SS-46 and CA-89DS

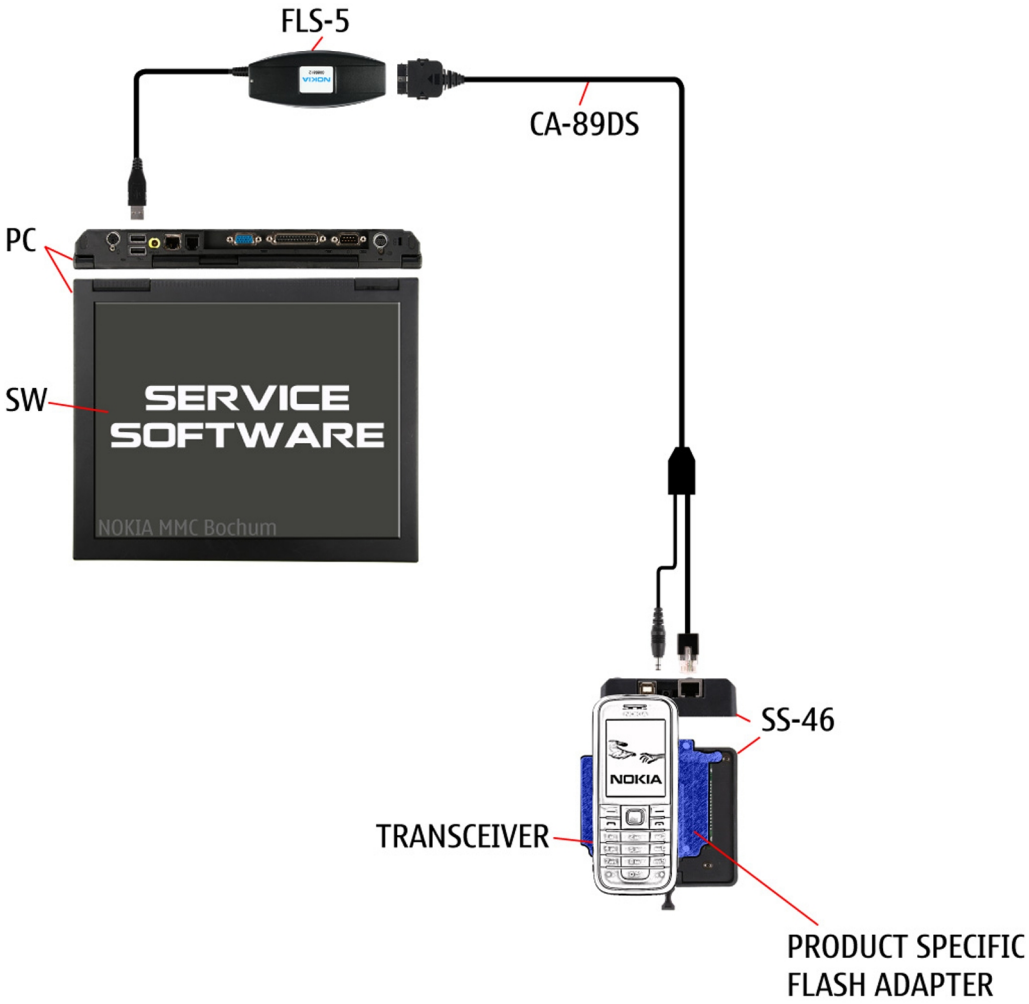

Figure 6 Flash concept with SS-46 and CA-89DS

Type	Description
Product specific tools	
FS-84	Flash adapter
Other tools	
FLS-5	Flash device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
CA-89DS	Cable

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Flash concept with SS-62 and CA-89DS

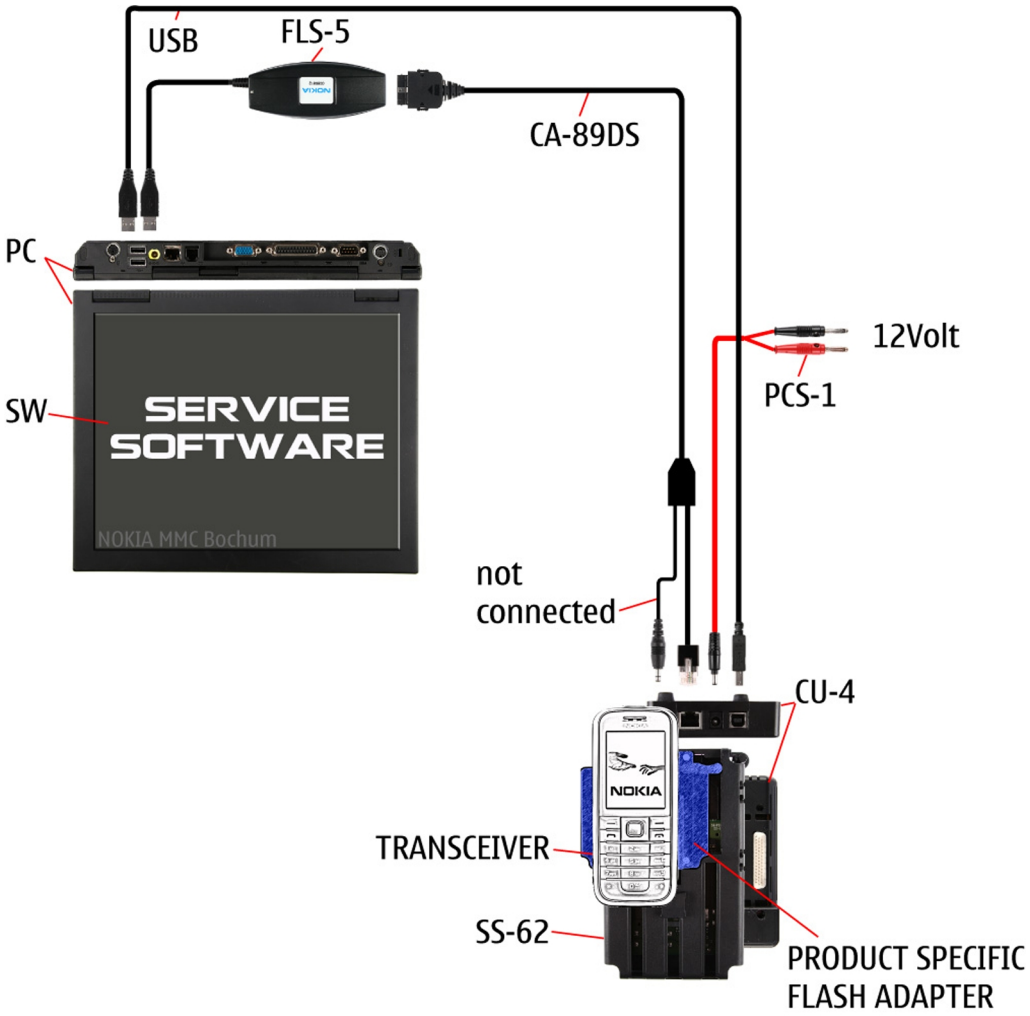

Figure 7 Flash concept with SS-62 and CA-89DS

Type	Description
Product specific tools	
FS-84	Flash adapter
Other tools	
CU-4	Control unit
FLS-5	Flash device
SS-62	Flash adapter base
	PC with Phoenix service software
Cables	
CA-89DS	Cable
PCS-1	Power cable
	USB cable

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Flash concept with FPS-10, SS-62 and SB-6

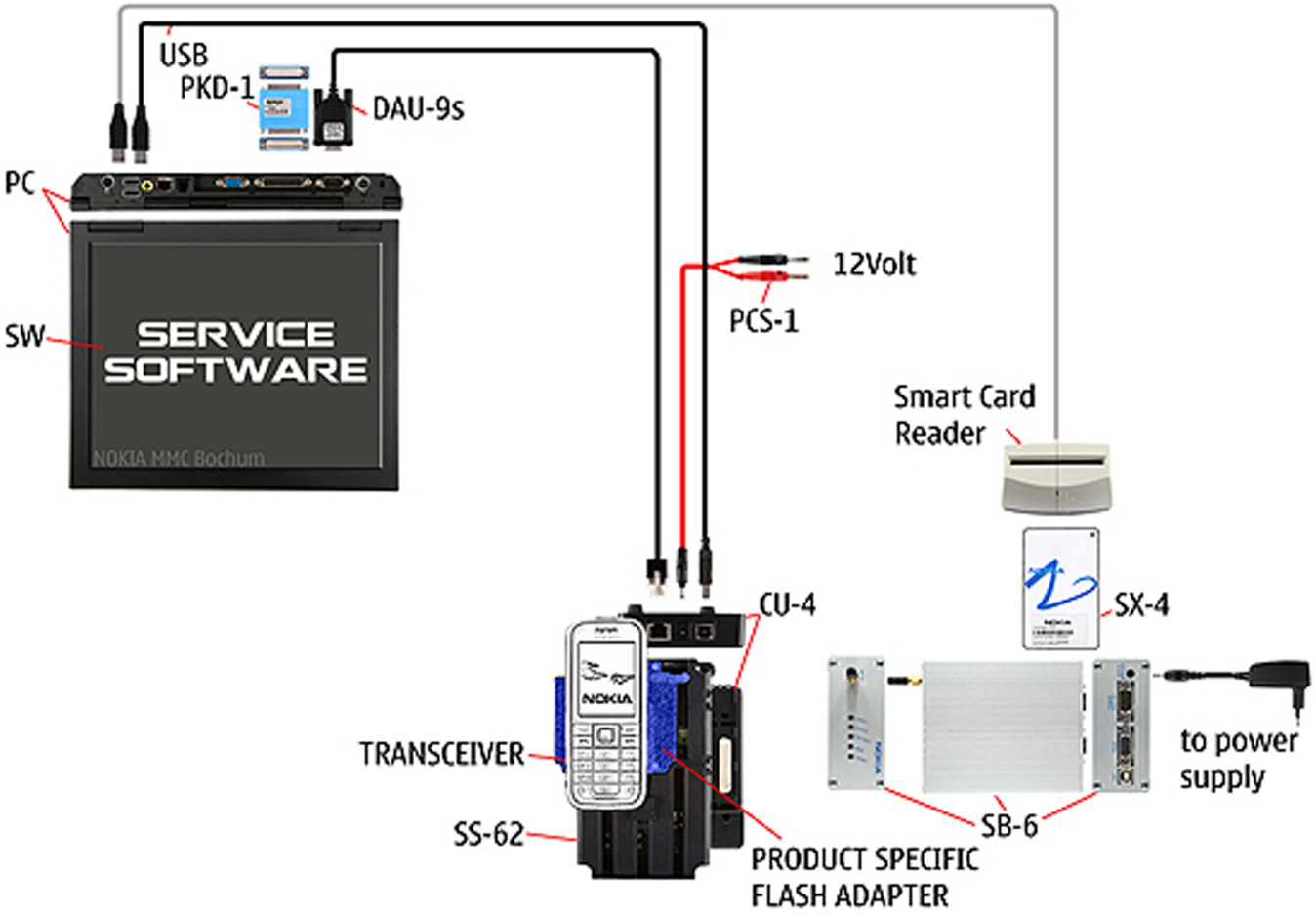

Figure 8 Flash concept with FPS-10, SS-62 and SB-6

Type	Description
Product specific tools	
FS-84	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SB-6	Bluetooth test and interface box
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable

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Type	Description
	USB cable

Flash concept with FPS-10, SS-62 and SB-7

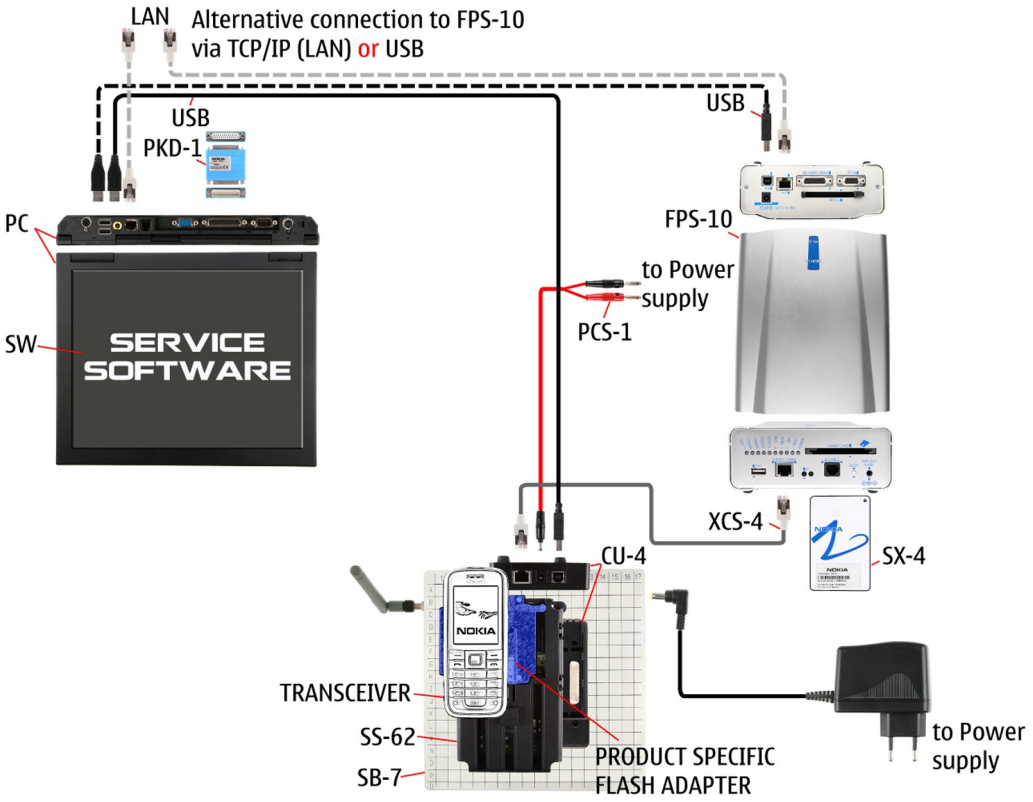

Figure 9 Flash concept with FPS-10, SB-7 and JBT-9

Type	Description
Product specific tools	
FS-84	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SB-7	WLAN test box
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable

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Type	Description
	USB cable

Module jig service concept

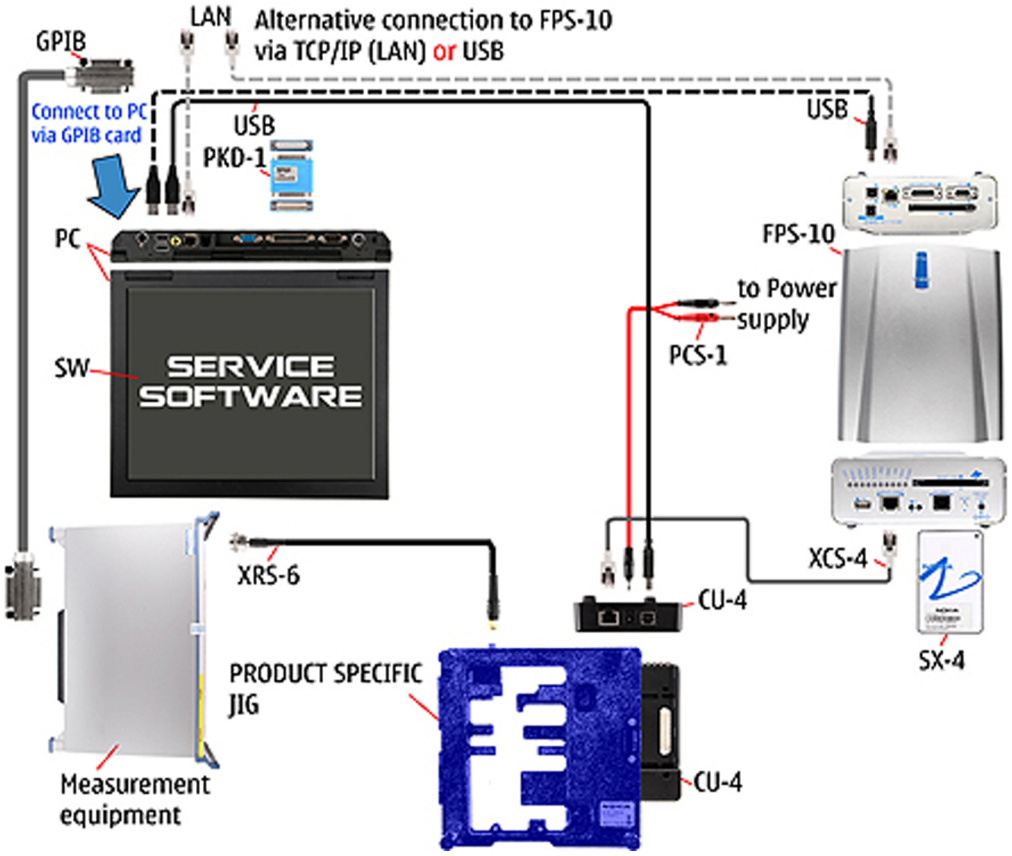

Figure 10 Module jig service concept

Type	Description
Phone specific devices	
MJ-173	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PK-1	SW security device
SX-4	Smart card
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable

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Type	Description
XRF-1	RF cable
	USB cable
	GPIB control cable

Module jig service concept with SB-6

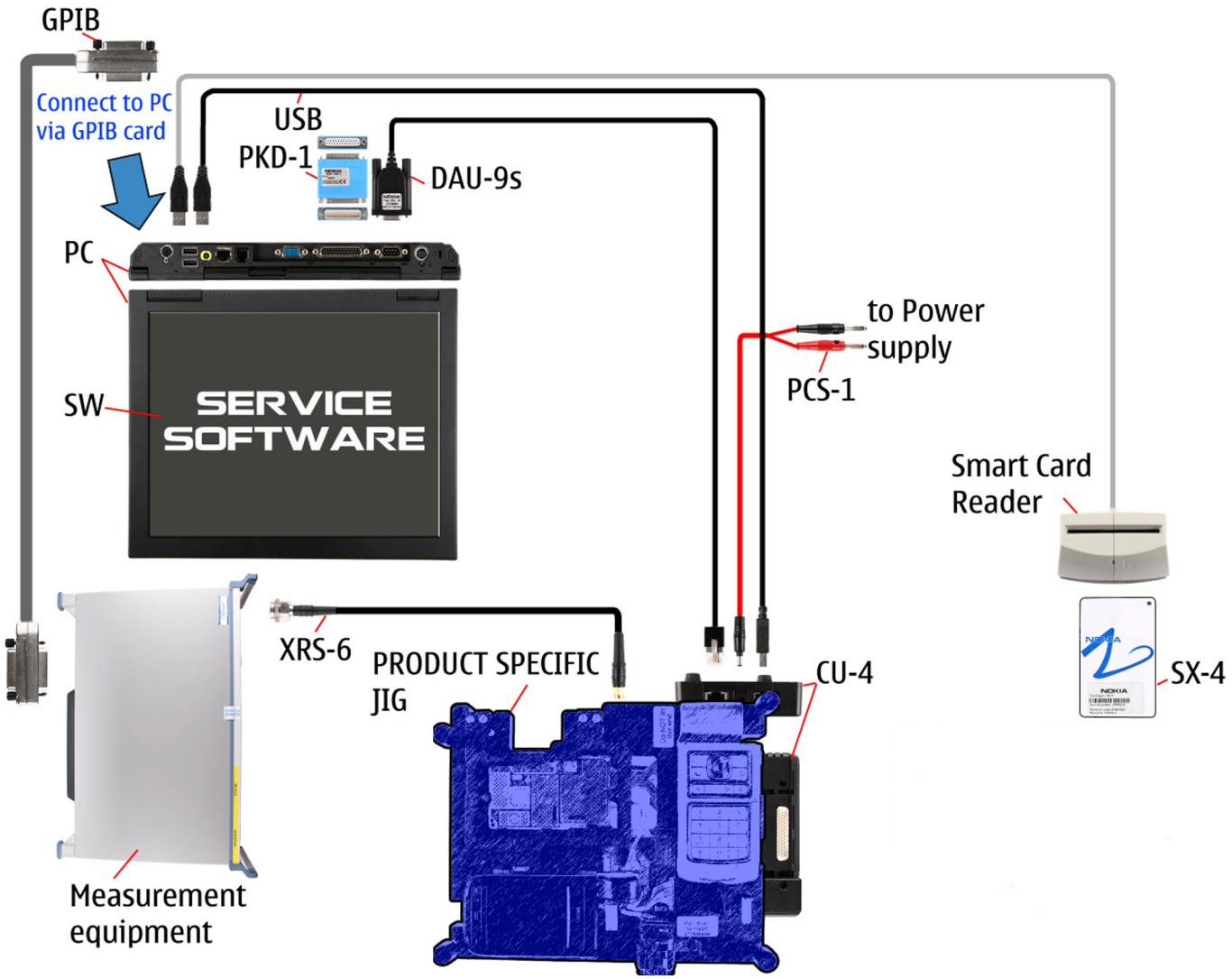

Figure 11 Module jig service concept with SB-6

Type	Description
Product specific tools	
MJ-173	Module jig
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
SB-6	Bluetooth test and interface box

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Type	Description
PKD-1	SW security device
SX-4	Smart card
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

RF testing concept with RF coupler

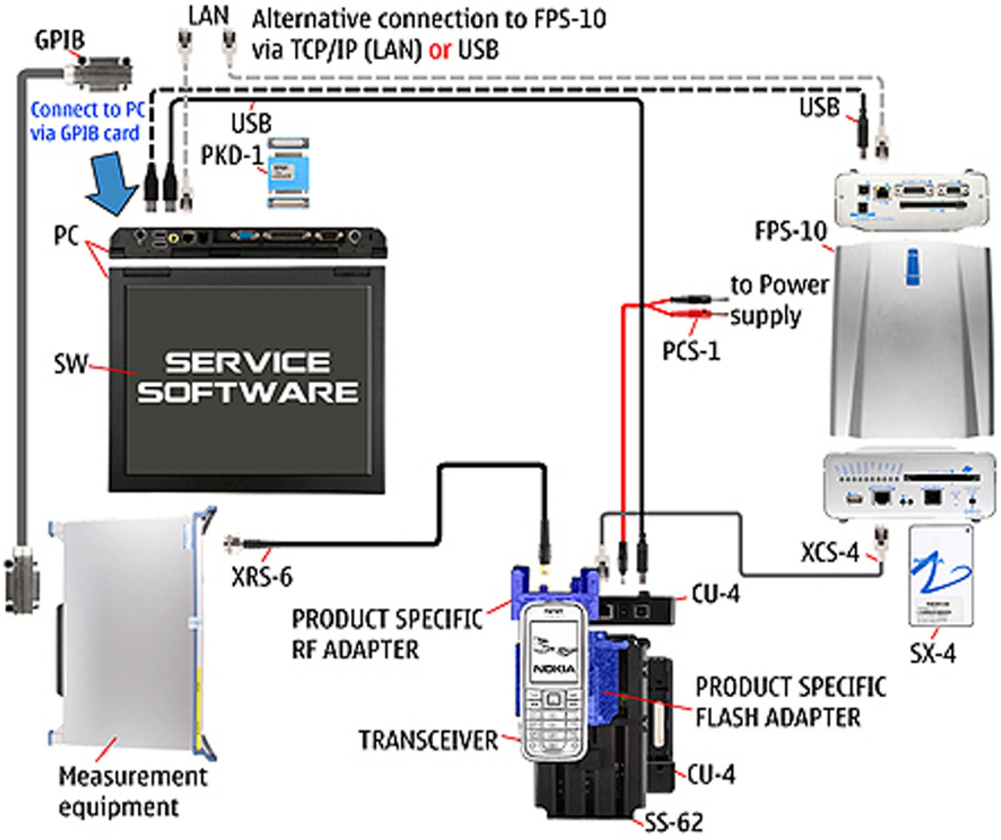

Figure 12 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-84	Flash adapter
SA-136	RF coupler
Other devices	

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Type	Description
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

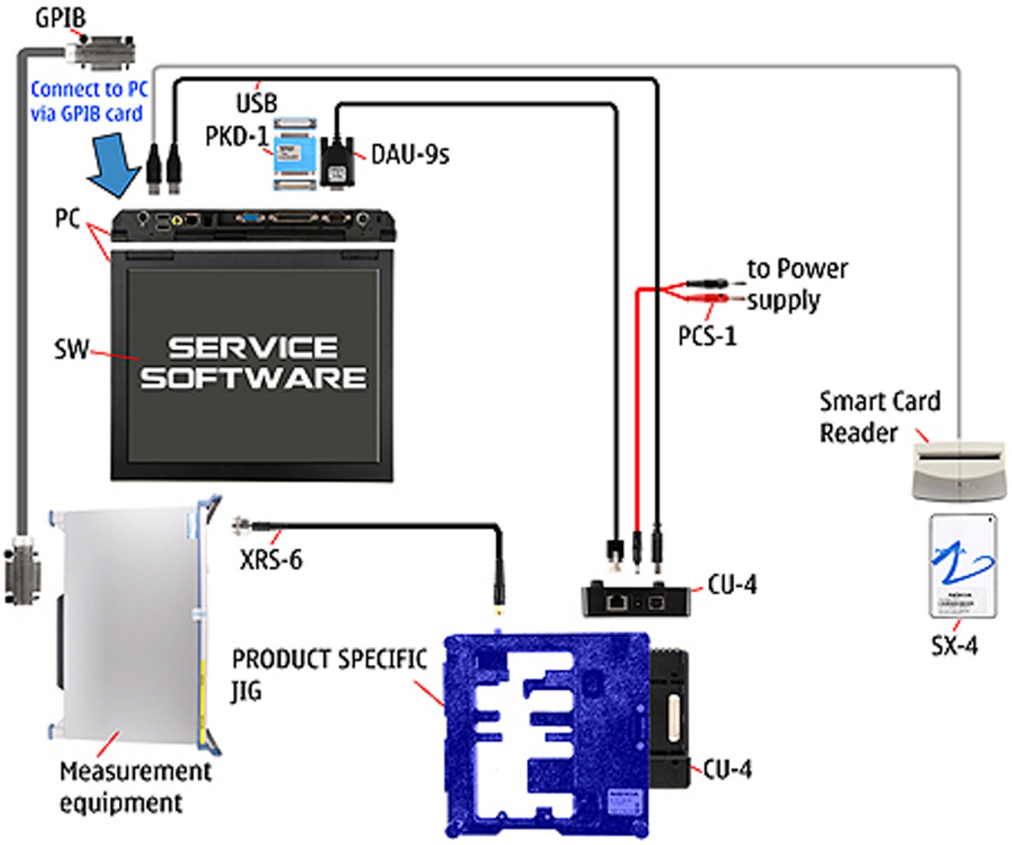

Figure 13 Service concept for RF testing and RF/BB tuning

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Type	Description
Product specific devices	
MJ-173	Module jig
Other devices	
CU-4	Control unit
PK-1/PKD-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

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3 — Baseband Troubleshooting

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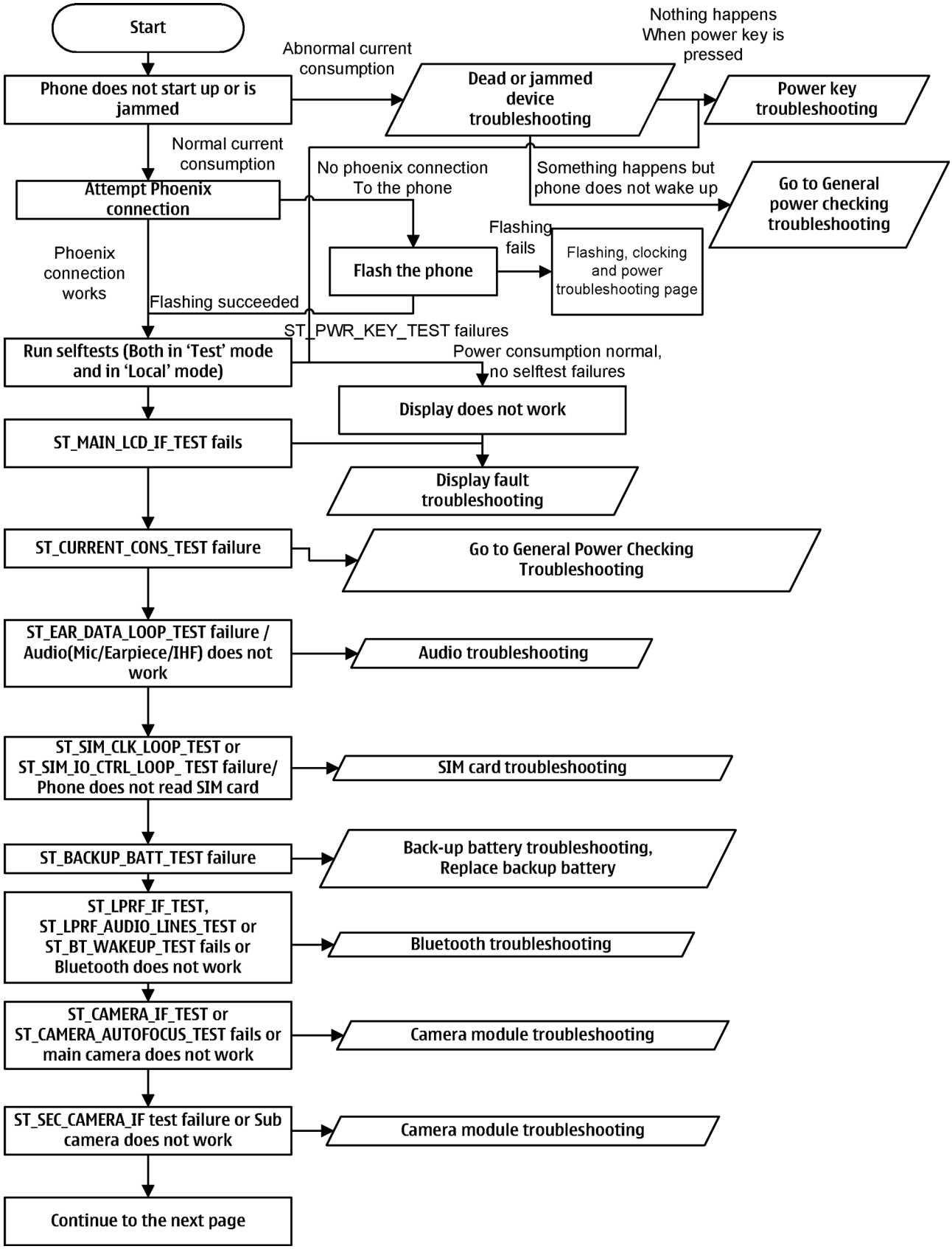
Baseband main troubleshooting

Troubleshooting flow



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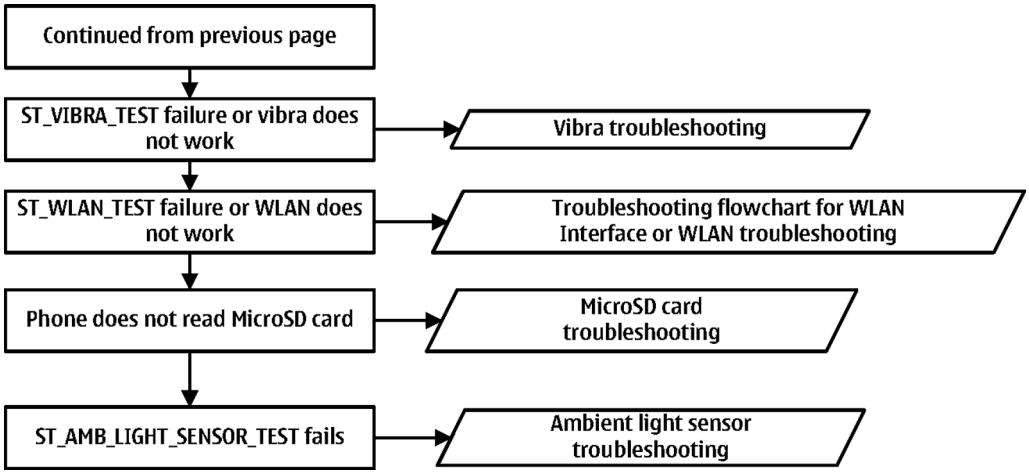
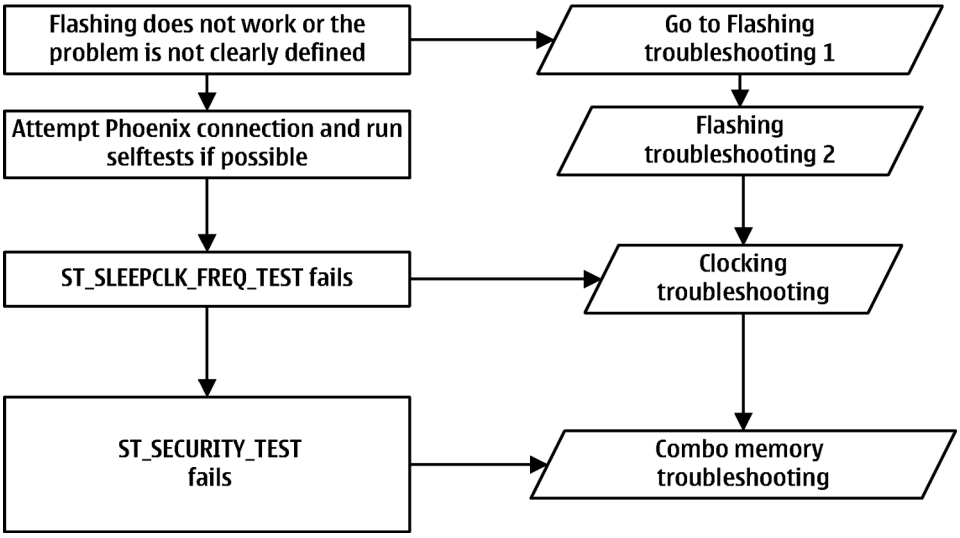


Flashing, clocking and power troubleshooting



General power checking

General power checking

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
VIOV	AVILMA	ON	ON	1.82	Vilma I/O, NCW, FMTx		VBAT1
VBACK	AVILMA	ON	ON	2.5	RTC circuitry		
VSIM1	AVILMA	ON	ON	1.8/3,0	SIM card		VBAT
VAUX	AVILMA	ON	ON	2.78	Displays		VBAT
VANA	AVILMA	ON	ON	2.5	Vilma internal		VBAT
VR1	AVILMA	OFF	ON	2.5	VCTCXO		VBAT
VRFC	AVILMA	OFF	OFF	1.8	RAPIDO converter		

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Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
VRCP1	AVILMA	OFF	OFF	4.75	RF module	RF active	VBAT
VOUT	BETTY	ON	ON	2,5	ALS		VBAT
VAUD	LP3985			3,0	DAC33	On when used	VBAT
VCAM_1V8	LM3677	OFF	OFF	1,8	Camera HWA , LP5952		VBAT
VCORE_1V3	LP5952	OFF	OFF	1,3	Camera HWA core		VCAM_1V8 (LM3677)
VCAM_2V8	LP3985	OFF	OFF	2,8	Cameras		VBAT
VCORE	TPS62350	ON	ON	1,2	Rapido core		VBAT
VIO	LM3677	ON	ON	1.8	VIO, VDRAM		VBAT
VDDB	SD levelshifter, LP2939	OFF	OFF	2,9	SD card	ON when used	VBAT
LEDOUT	TK65604	OFF			Keyboard and display backlights		VBAT
FLASH LED+ FLASH LED-	ADP1653	OFF	OFF	4,5/5,5	Camera flash		VBAT
VBAT				3,6			
VCAM_ACT	LP3985	OFF	OFF	3.0	Camera		VBAT
VOut	TK63128	OFF	OFF	2.8	NCW		VBAT

Backup battery troubleshooting

Verify that the backup battery G2200 is empty (U<1V). Switch the phone on. Measure voltage of the battery when the main battery is connected to the phone and the phone is switched on. Wait a few minutes and monitor that the backup battery voltage rises. Switch off the phone, disconnect the main battery and monitor that the voltage of the backup battery decreases. Normal behaviour of the voltage is described in the figures below:

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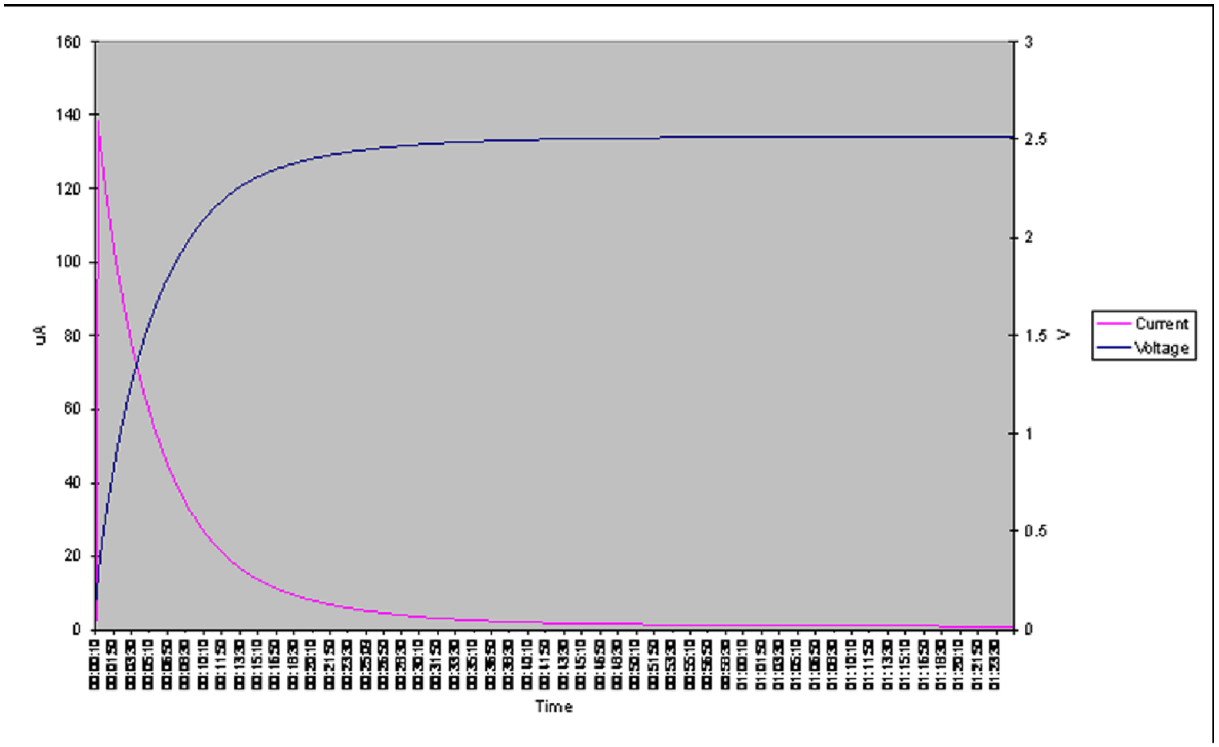

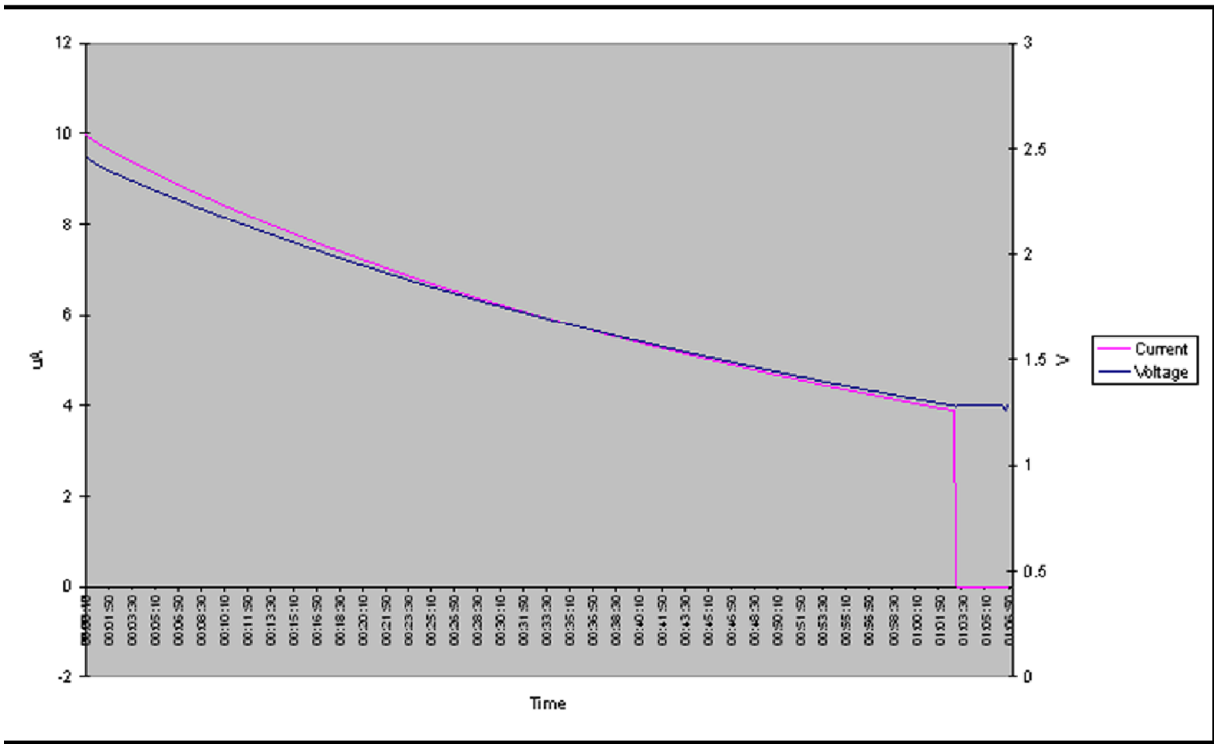

If the voltage rises and falls quickly, check the back-up battery G2200 contacts for loose soldering or short-circuit, and repair or change G2200 if necessary. If the voltage stays ~0V, check resistance VBACK against GND. If there is no shortcircuit, AVILMA N2200 is faulty. Replace N2200.

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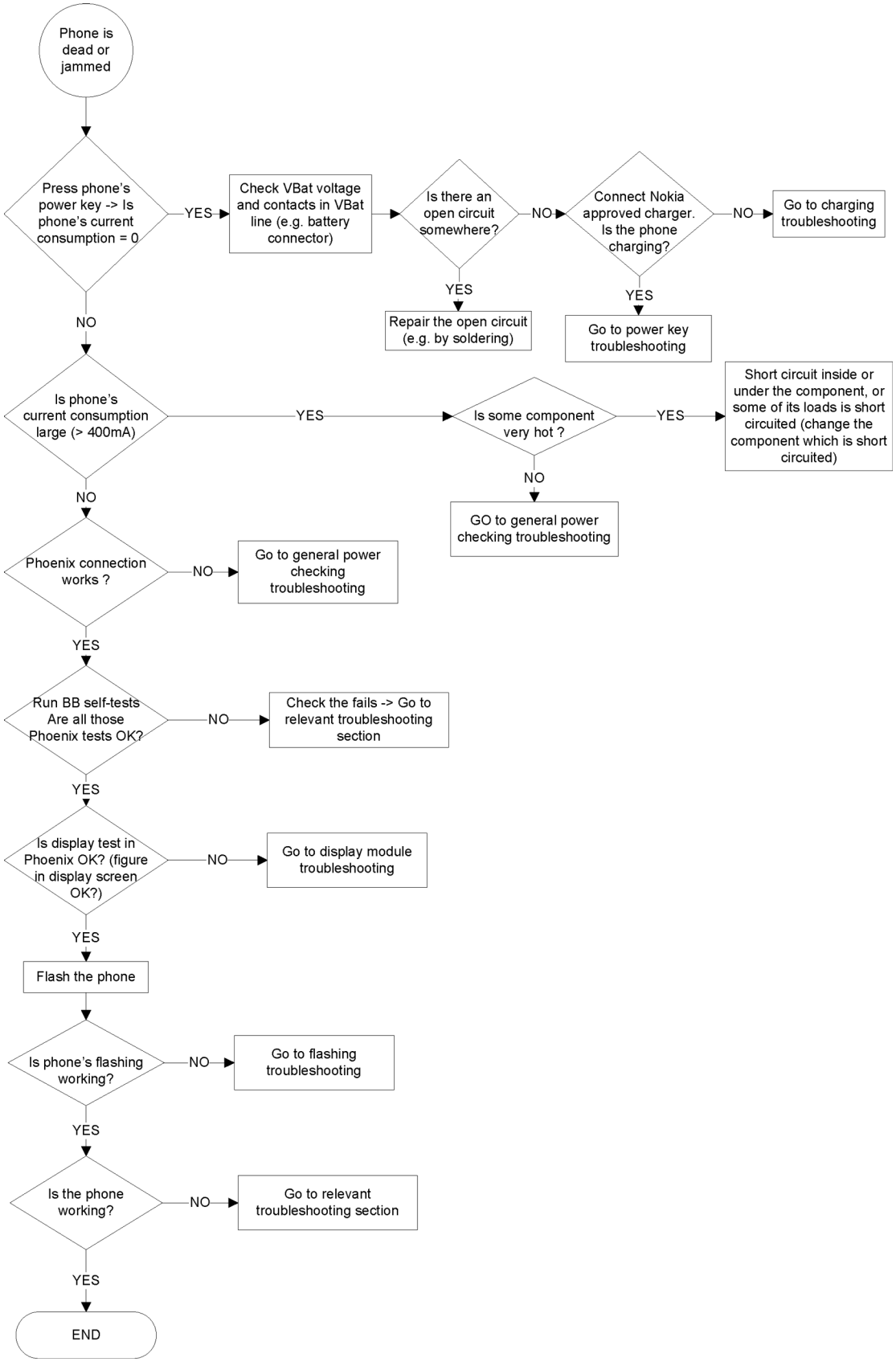
Dead or jammed device troubleshooting

Troubleshooting flow



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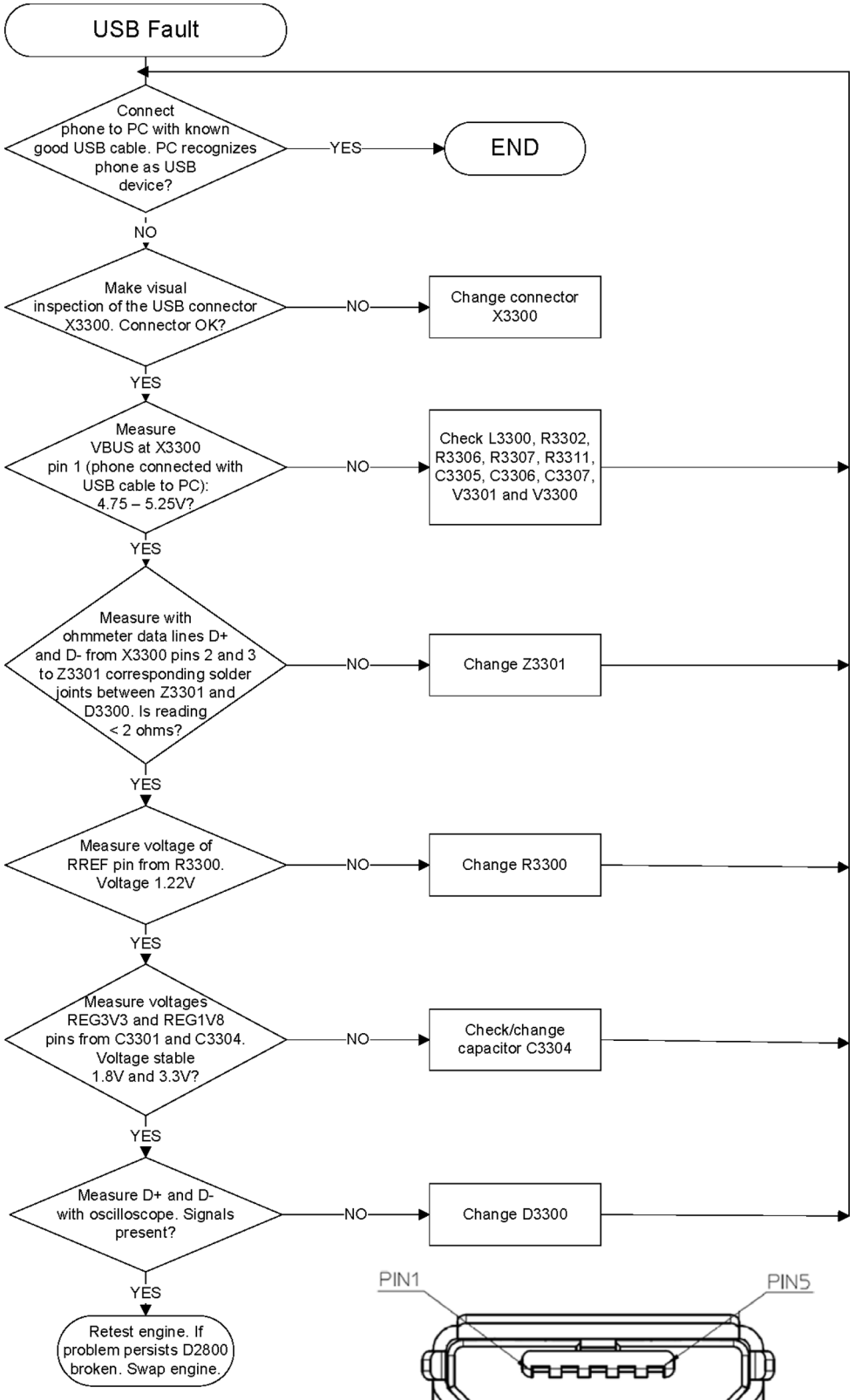
USB troubleshooting

Troubleshooting flow



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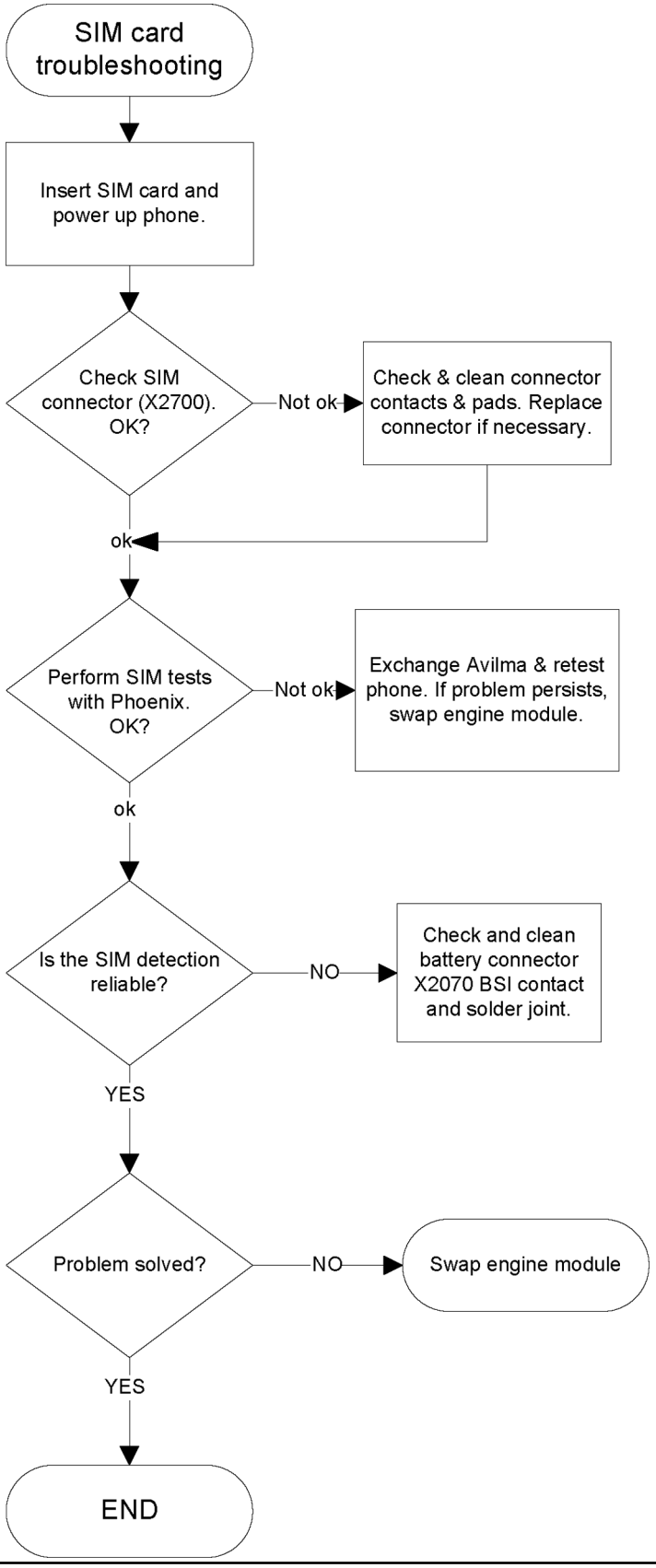
SIM card troubleshooting

Troubleshooting flow



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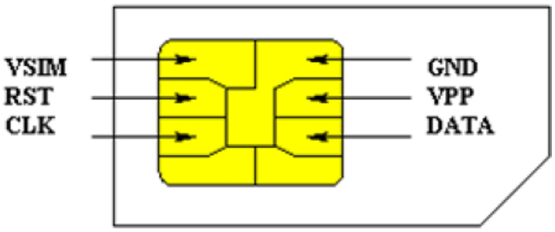
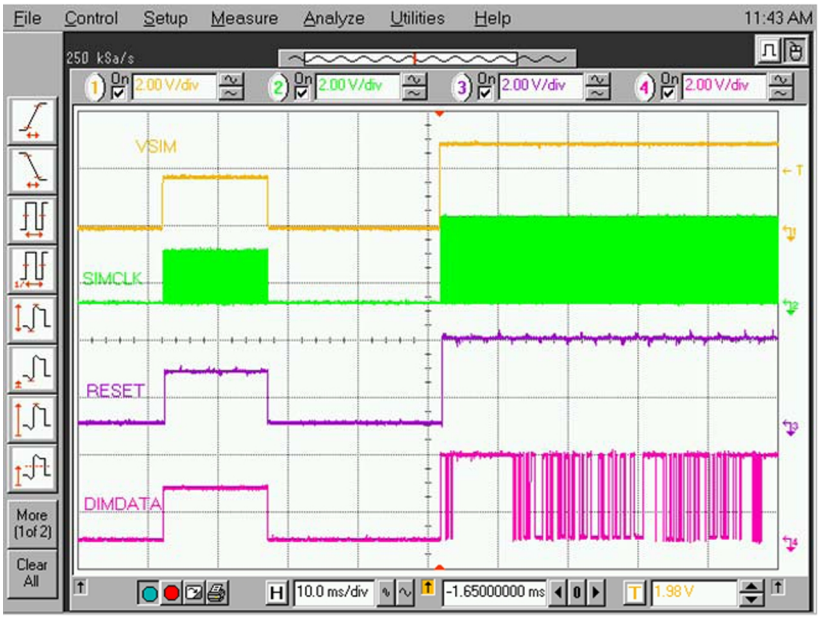
SIM power-on sequence

Testpoints between
Rapido and AVILMA
SIMCLK = C2210
SIMDATA = C2797
SIMIOC=SIMRST = C2798

Fsimclk = 3.2MHz



SIM contacts



SIM power-on sequence on X2700.

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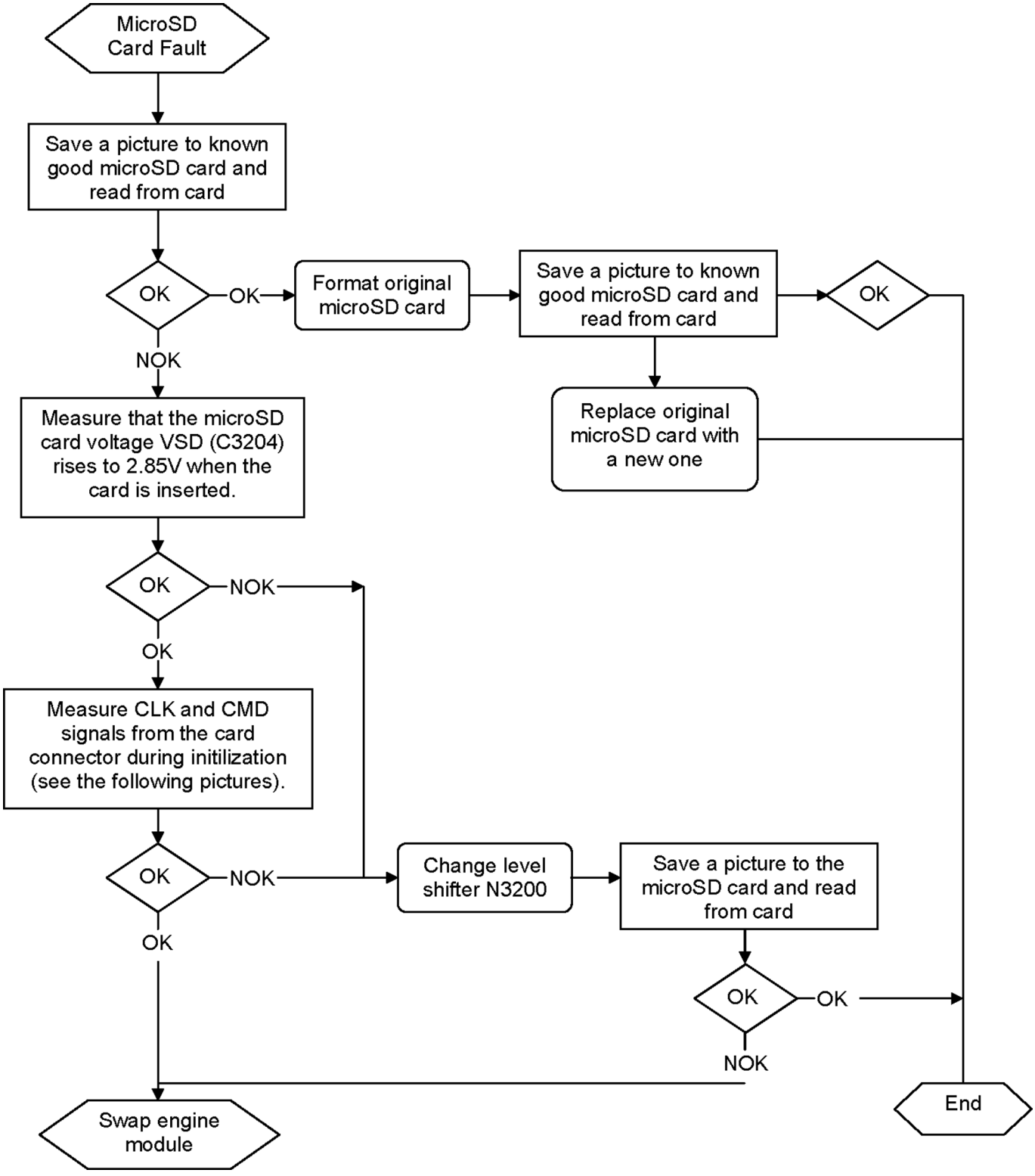
MicroSD card troubleshooting

Troubleshooting flow



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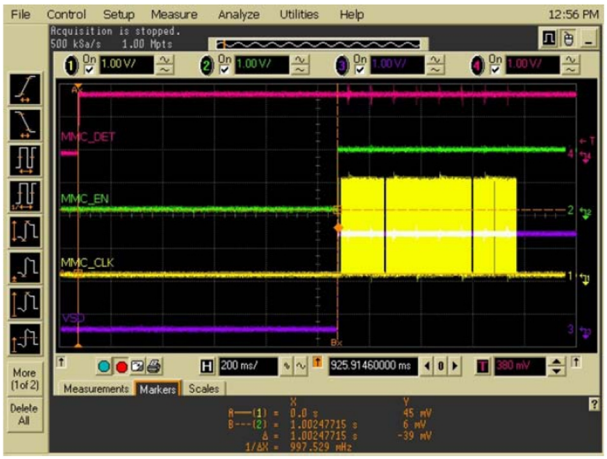
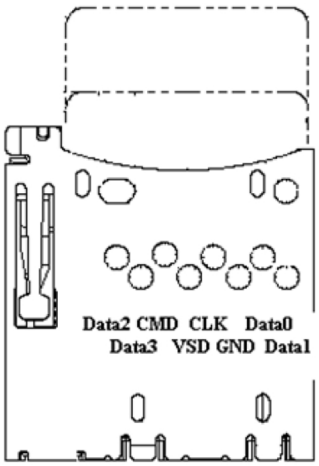
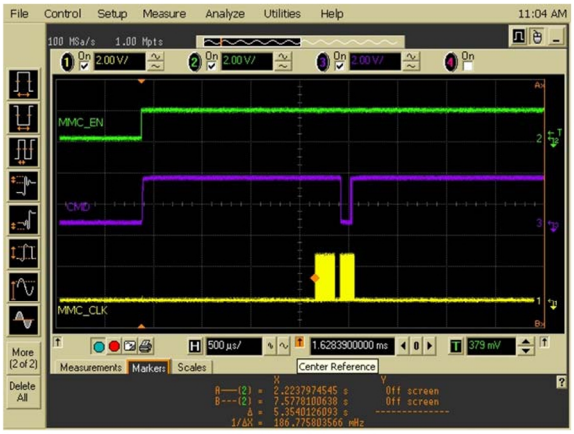


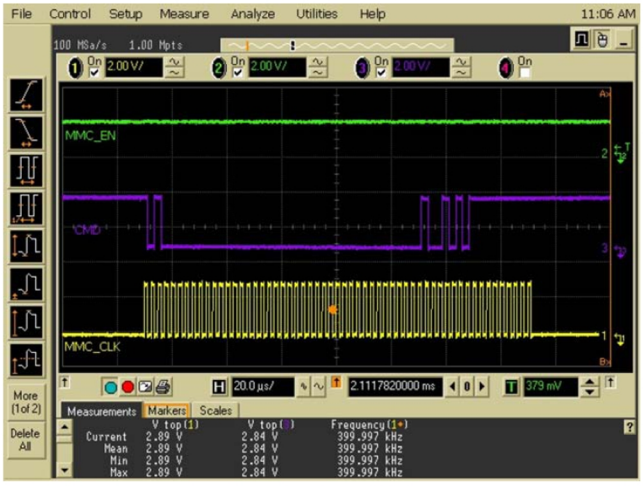
MicroSD interface signals timing when card is inserted.



MicroSD connector



CLK and CMD signals during card initialisation when card is not inserted. Measured from the microSD connector.



CLK and CMD signals during card initialisation when card is not inserted. Measured from the microSD connector

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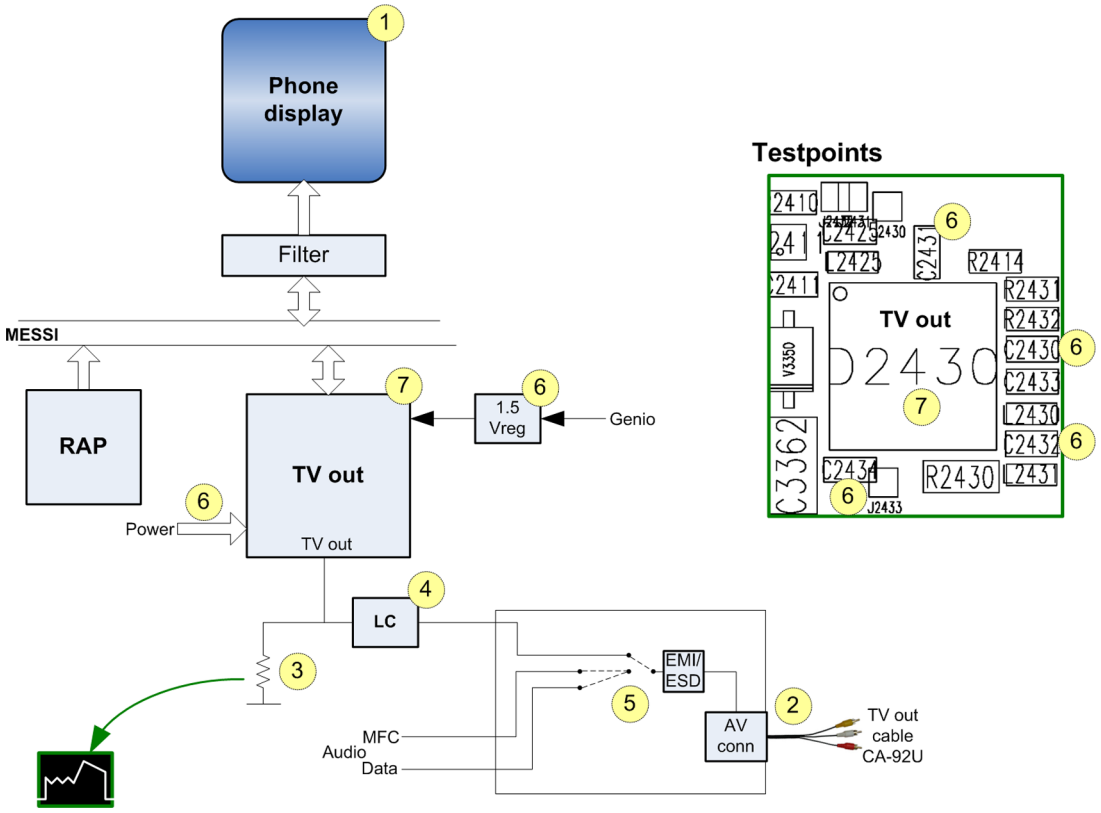
TV out troubleshooting

Troubleshooting flow



Steps

1. Make sure the phone display is working.
2. Make sure TV out cable is plugged into both phone and TV set.
   If no image is shown on TV, make sure it is selected in phone SW:
   Tools→Setting→General→Enhancement→TV out (open)→TV system →Select appropriate TV setting
3. Check TV out signal (R2485).
4. Check R2482 (should be 560 Ω), R2481 (should be 1500 Ω), C2470, C2471, C2472 and L2470.
5. Check switch EMI/EDS + AV connector (N2003, C2137, L2010, R2013, E2012).
6. Verify voltage over these capacitors:
   C2481 (VIO) = 1.72 V - 1.92 V
   C2480 (VTVOUT) = 1.44 V - 1.56 V
   C2482 (PLLVDD) = 1.44 V - 1.56 V
   C2484 (DACVCC) = 2.66 V - 2.86 V
7. Replace TV out ASIC (D2480).
8. Retest after each repair/replaced part.

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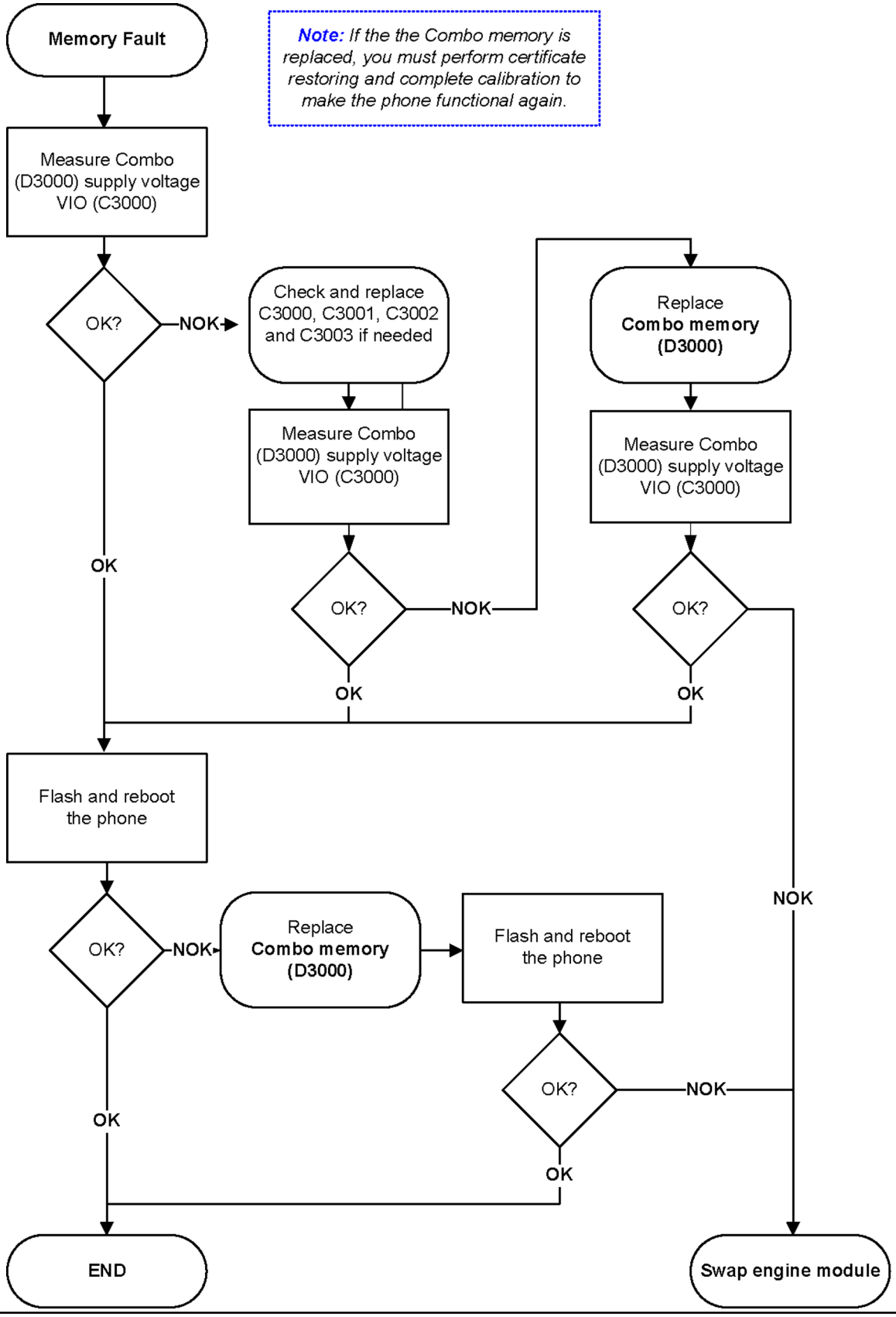
Combo memory troubleshooting

Troubleshooting flow



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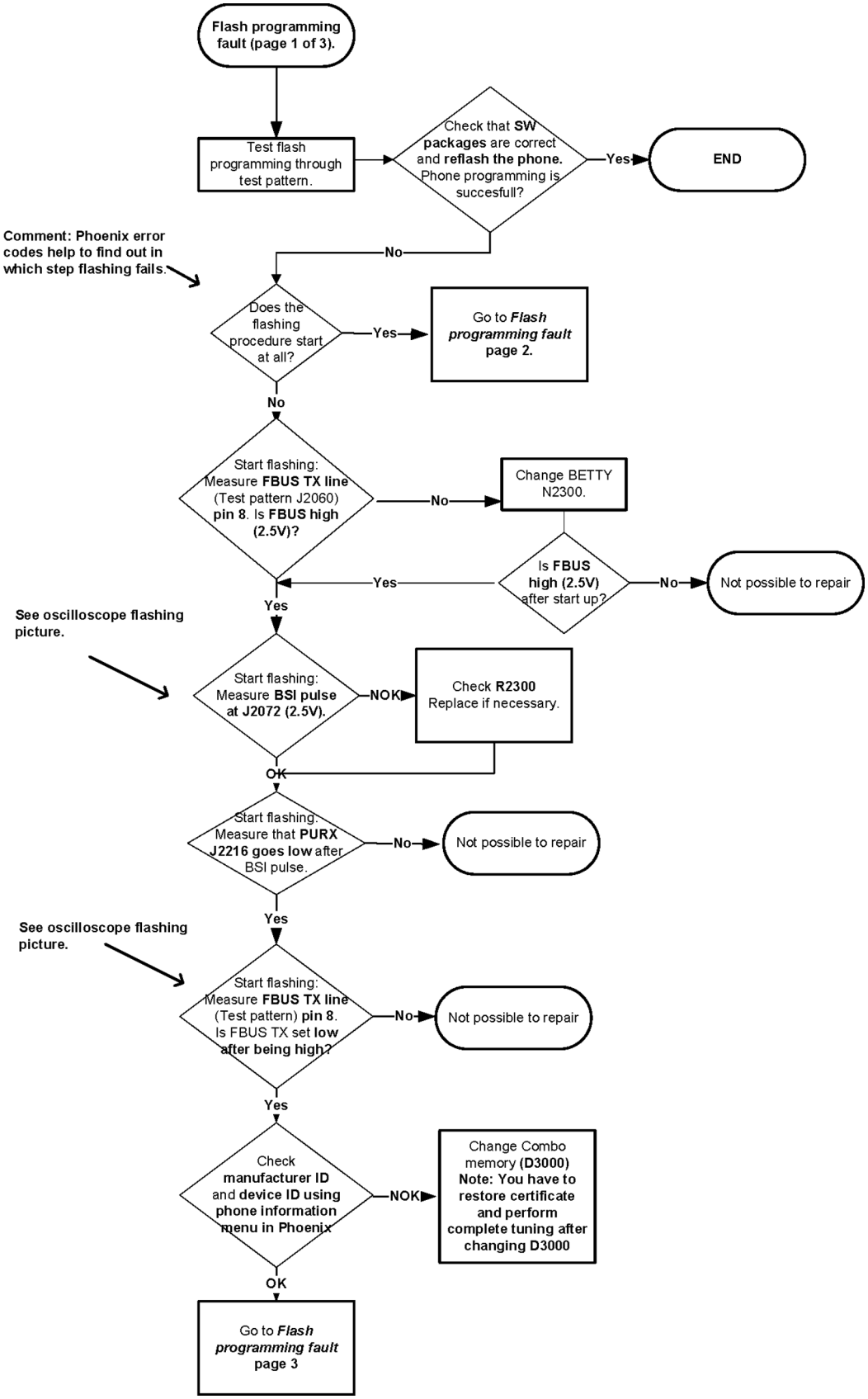
Flash programming troubleshooting

Troubleshooting flow



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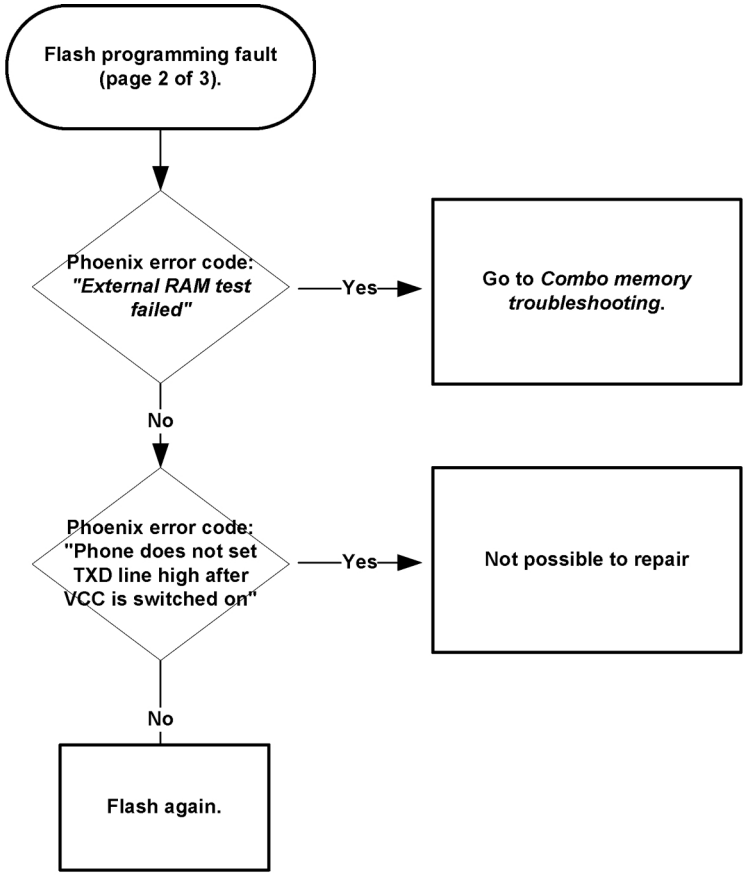

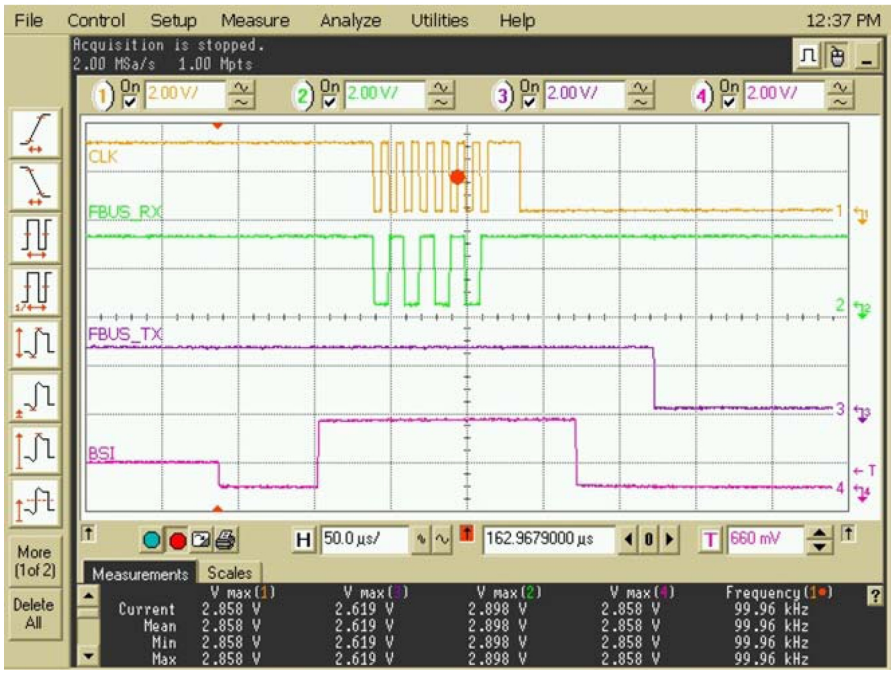

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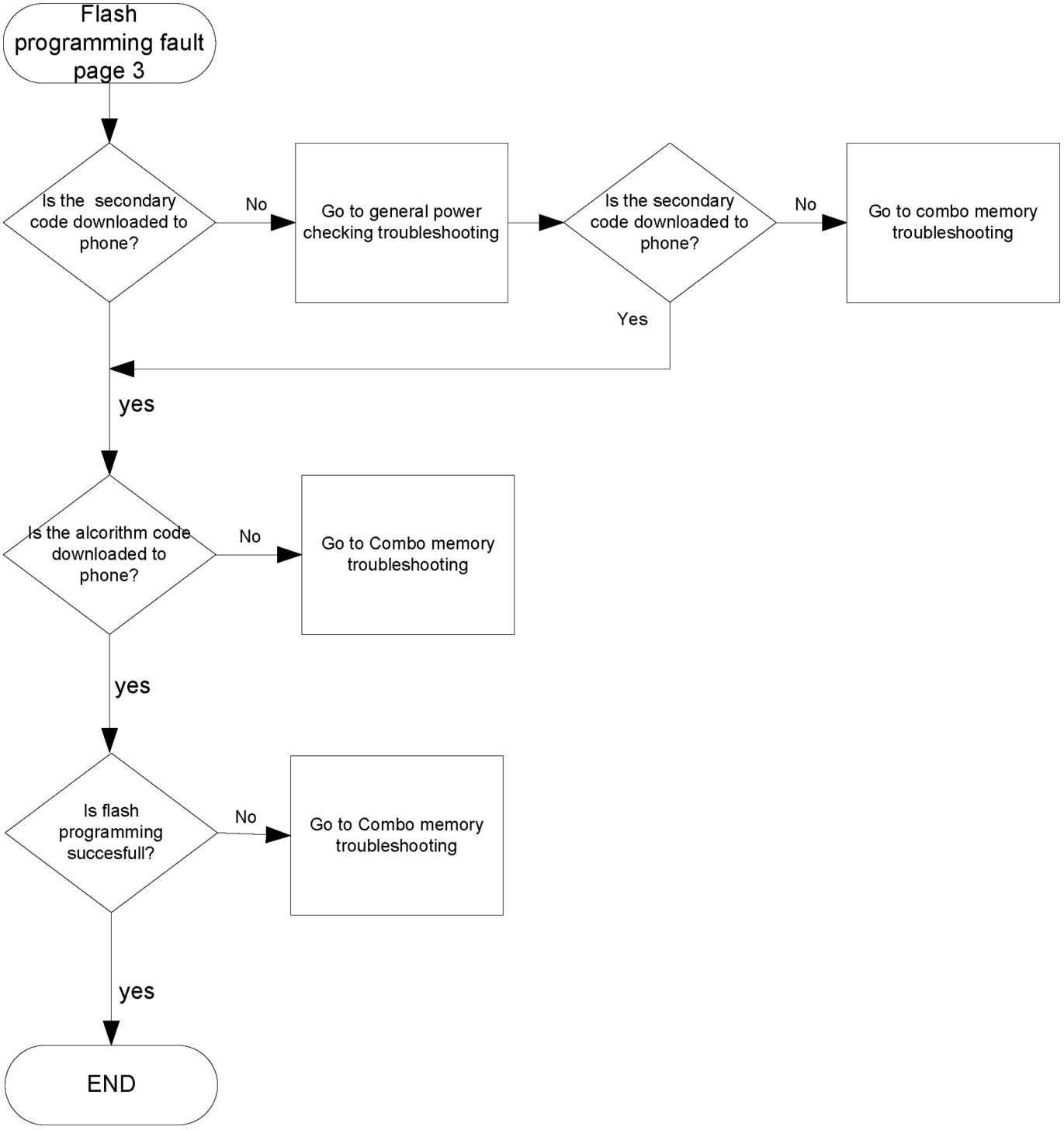

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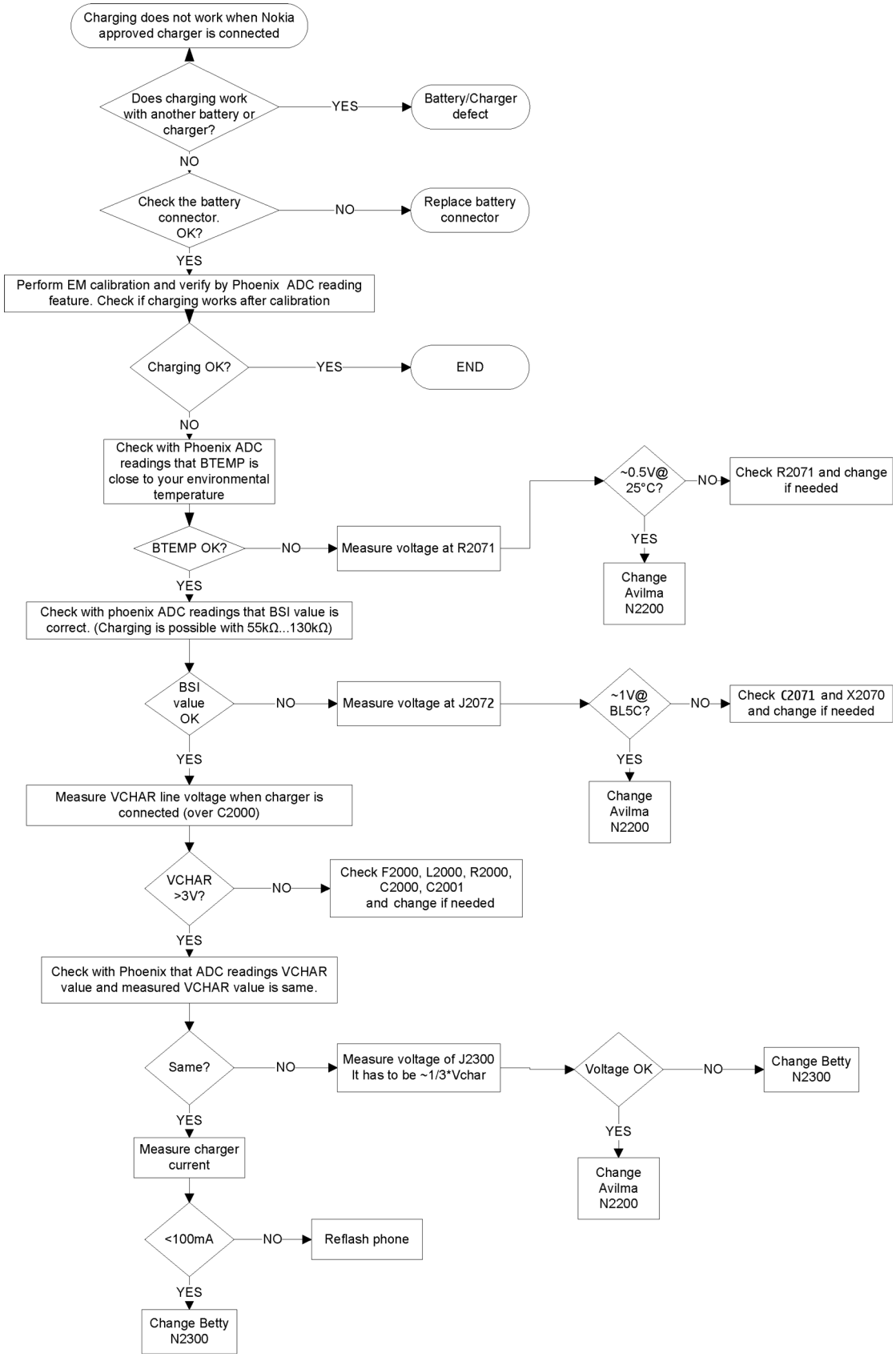
Charging troubleshooting

Troubleshooting flow



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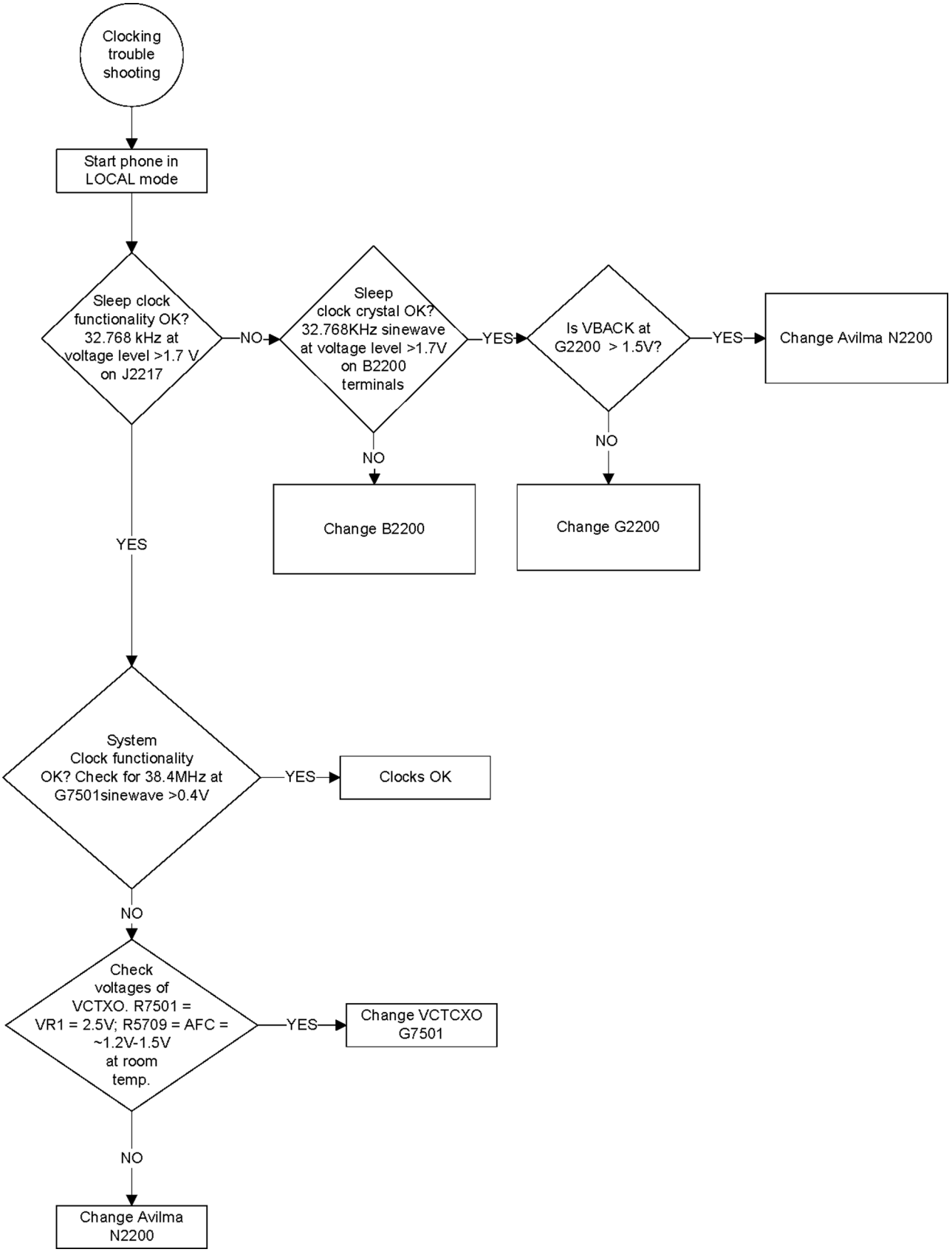
Clocking troubleshooting

Troubleshooting flow



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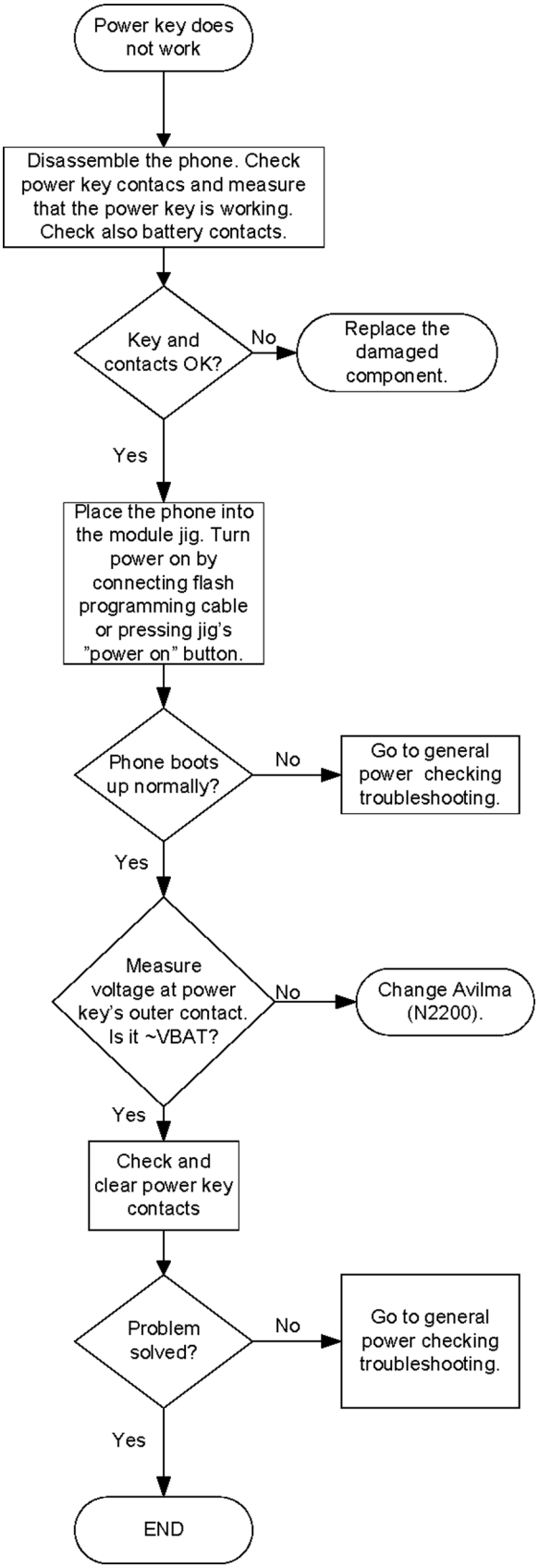
Power key troubleshooting

Troubleshooting flow



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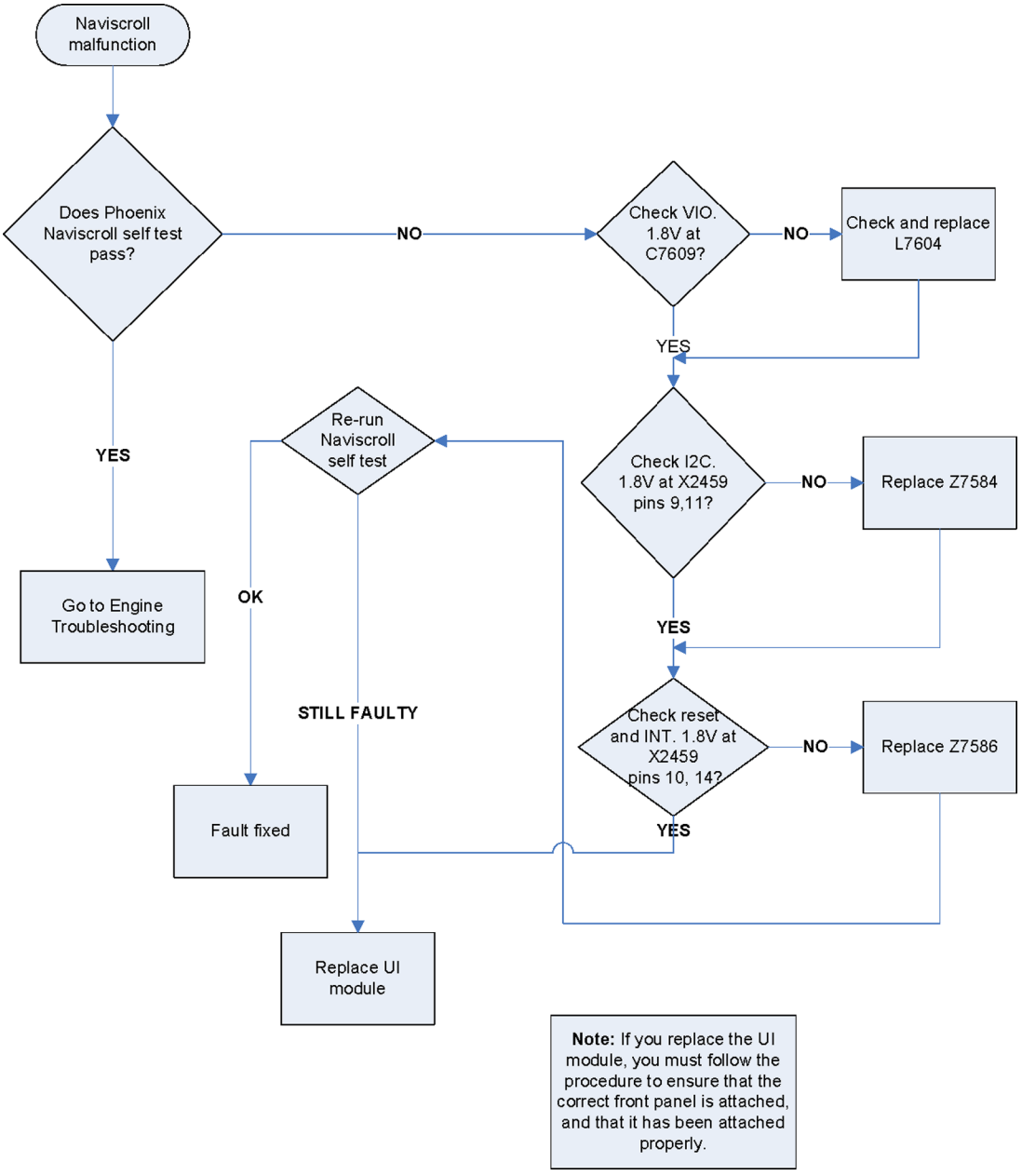
Naviscroll troubleshooting

Troubleshooting flow



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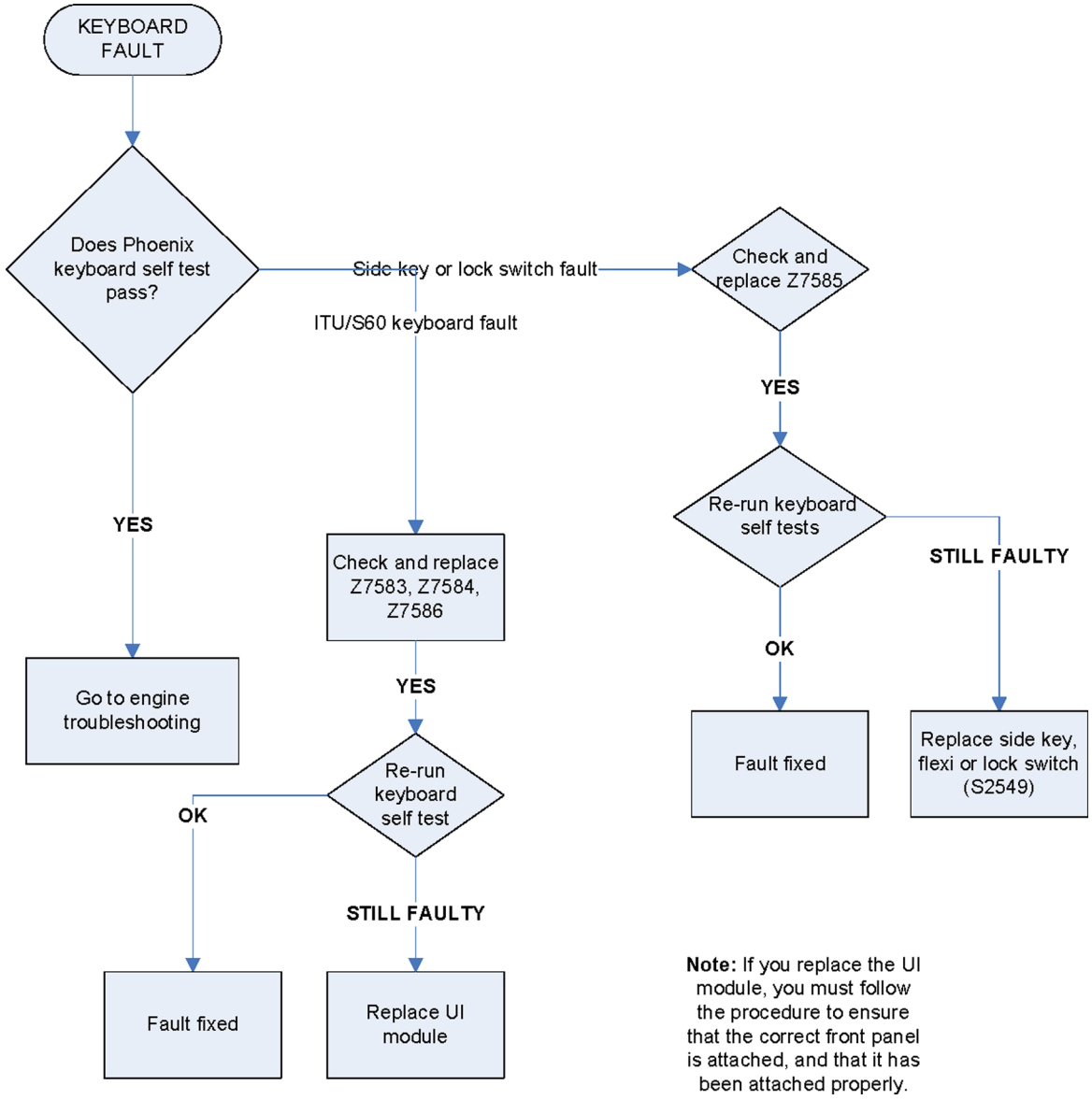
Keyboard troubleshooting

Troubleshooting flow



Display Technical Description and Troubleshooting

Display

Display features

- 2.4" Active TFT QVGA display supports up to 16,777,216 colors (240 x 320 pixels, 2.4 inches)
- Wide 160° viewing angle
- Ambient light detector to optimize display brightness and power consumption

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Display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- The operating modes of the display can be controlled with the help of Phoenix.

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display.

The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented in the following tables.

Table 8 Minimum distance between dot defects

Internal defect	Bright dot 0 Dim dot 2 (Total 2)

Table 9 Visual defects

Visual defects	Allowable (mm)
Bright dots	None
Dim dots	S < = 5
Any allowable defects	S < = 5

Steps

1. Verify with a working display that the fault is not on the display module itself. The display module cannot be repaired.
2. Check that the cellular engine is working normally.

   i To check the functionality, connect the phone to a docking station.

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ii StartPhoenix service software.

iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the Phone ID).

3. Proceed to the display troubleshooting flowcharts. Use the **Display Test tool** in Phoenix to find the detailed fault mode.

   Before going to display troubleshooting flow make sure that engine is working and starting up correctly otherwise go to BB troubleshooting.

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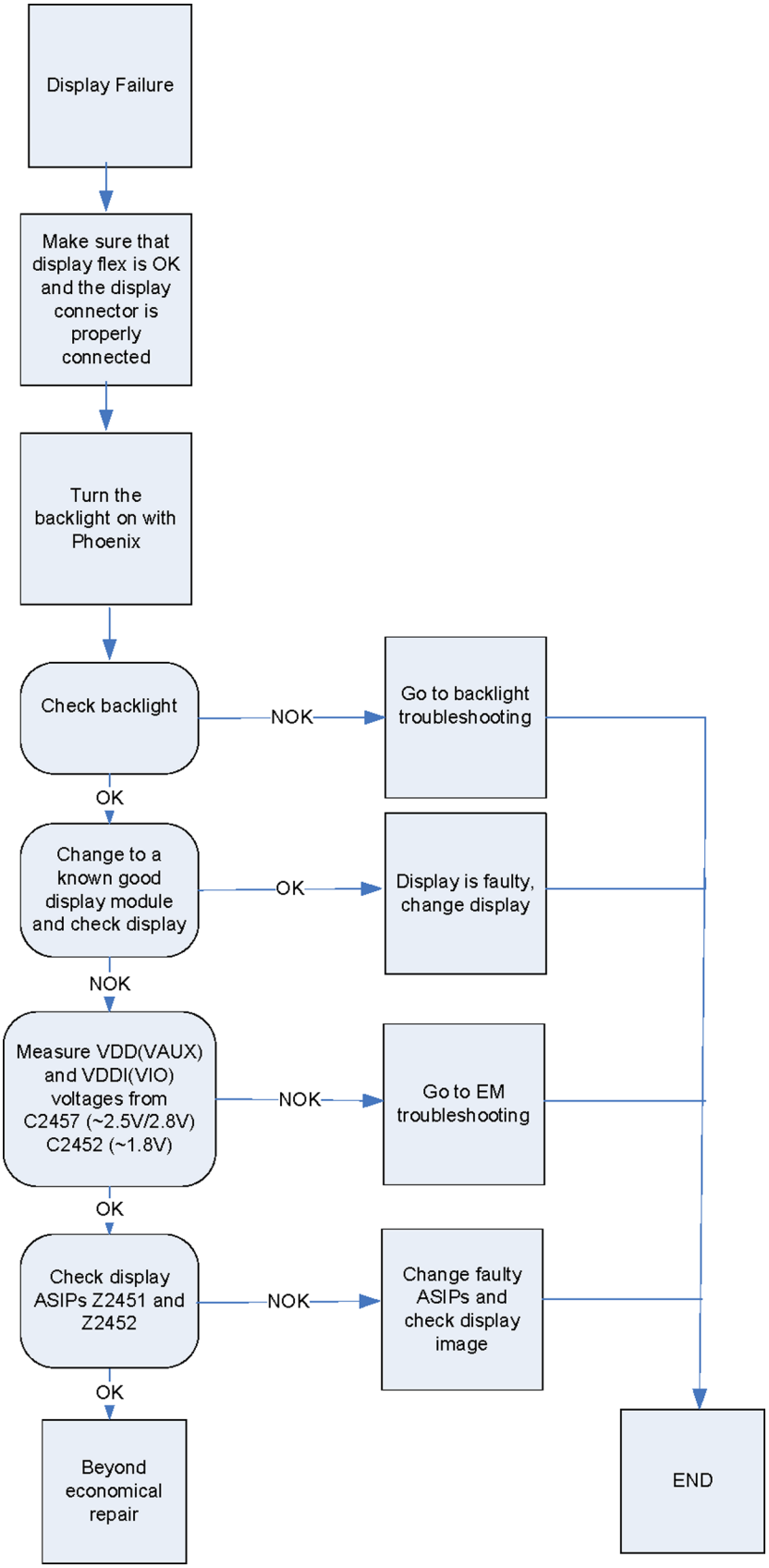

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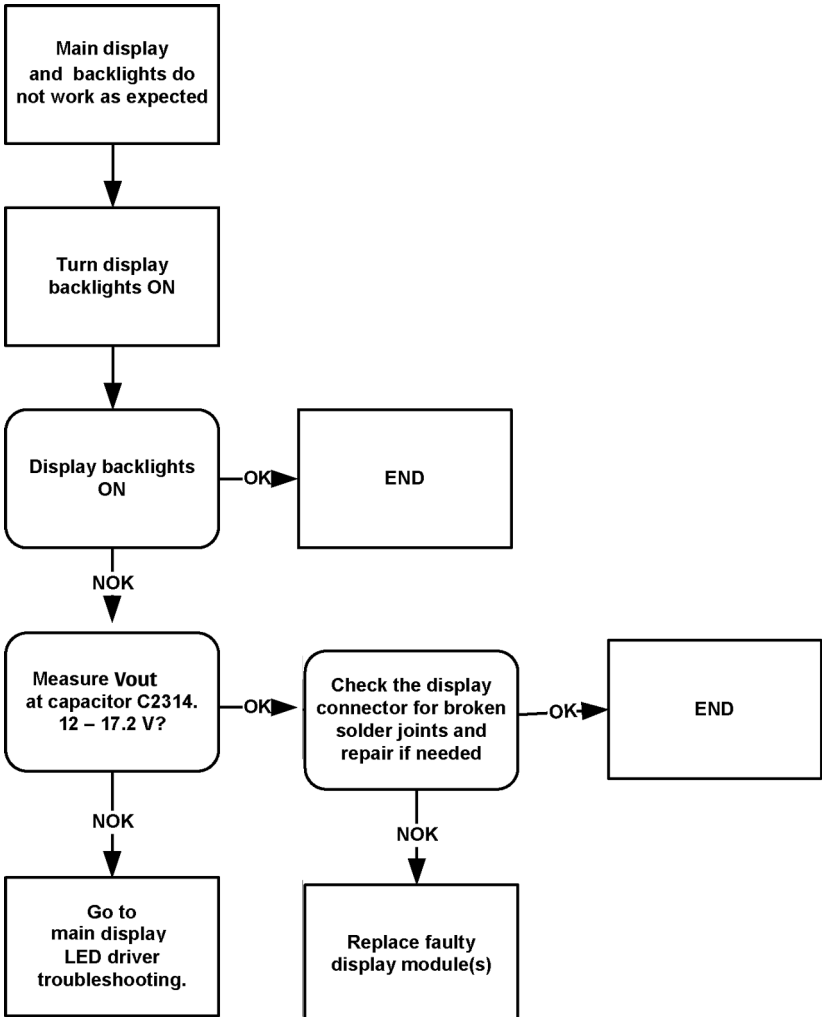
Display backlight and illumination troubleshooting

Troubleshooting flow



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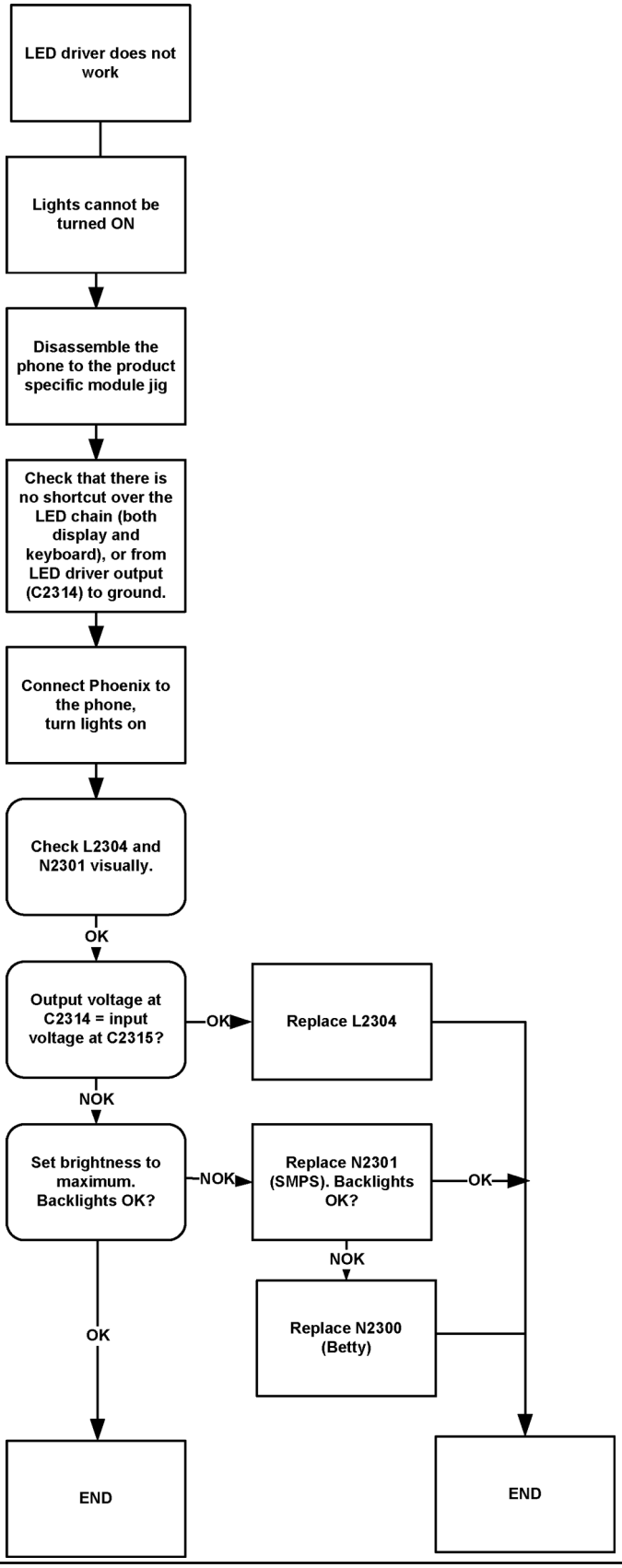
LED driver troubleshooting

Troubleshooting flow



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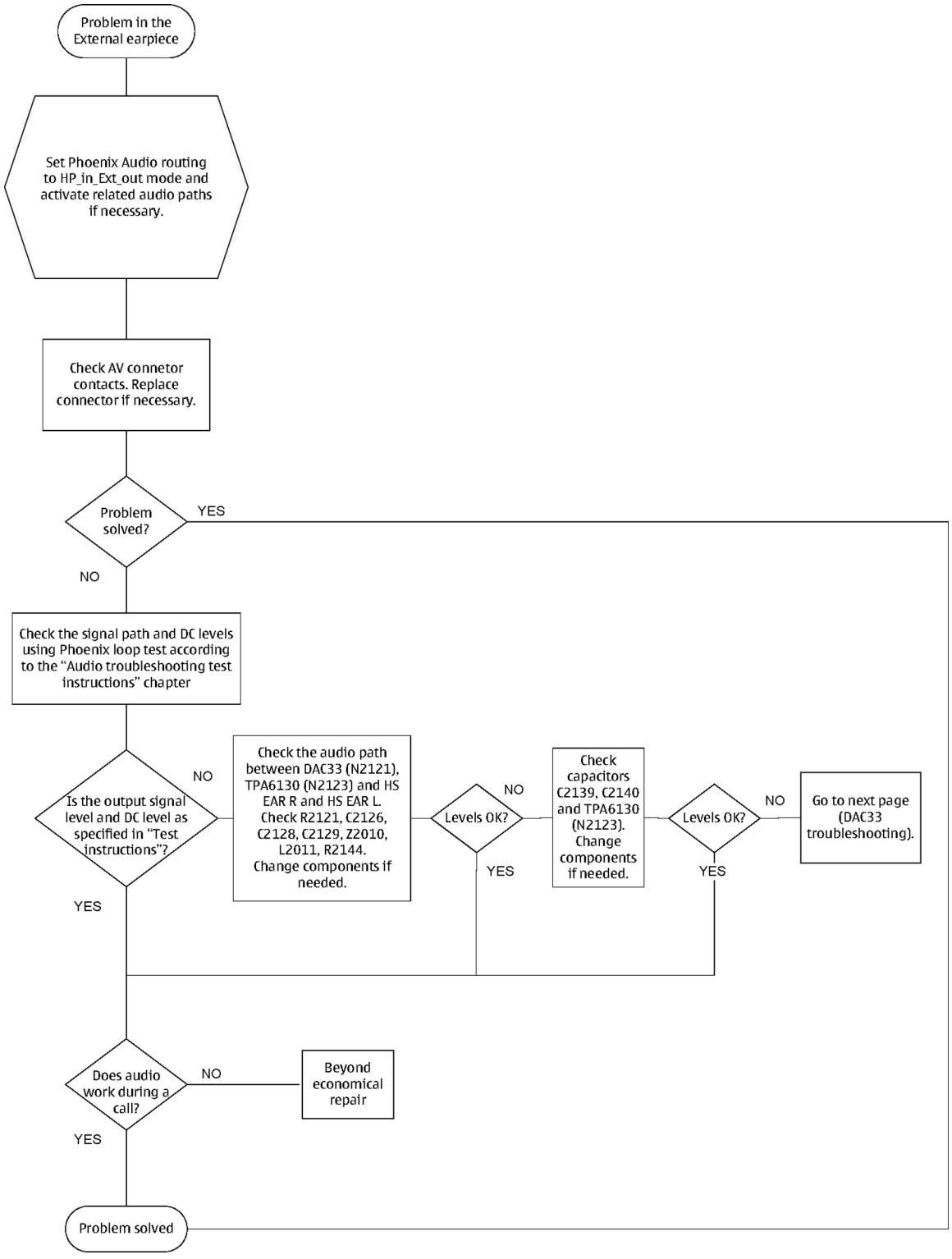
Audio Troubleshooting

External earpiece troubleshooting 1 and 2

Troubleshooting flow



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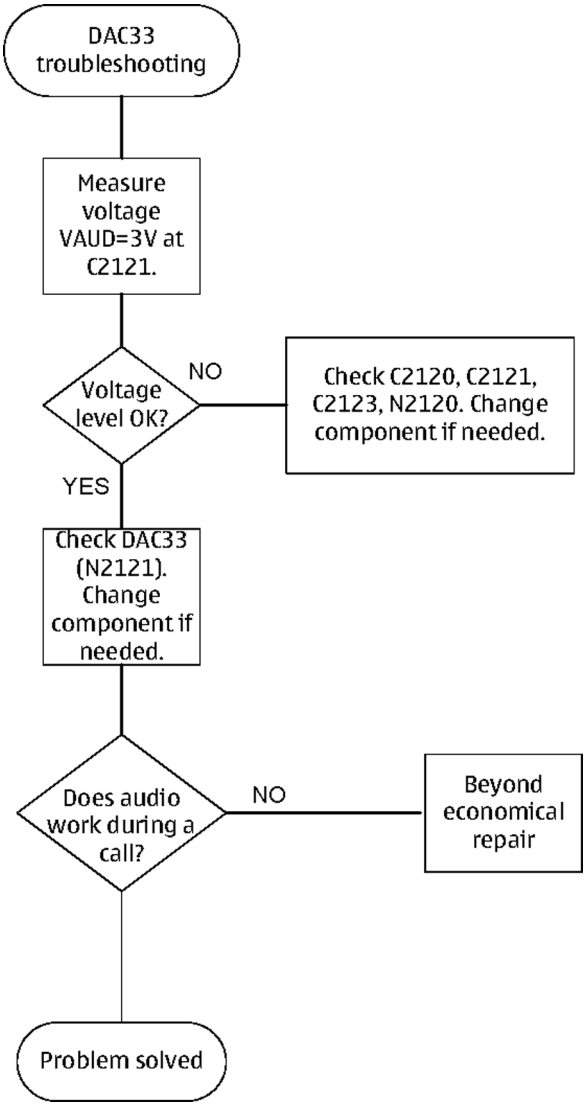

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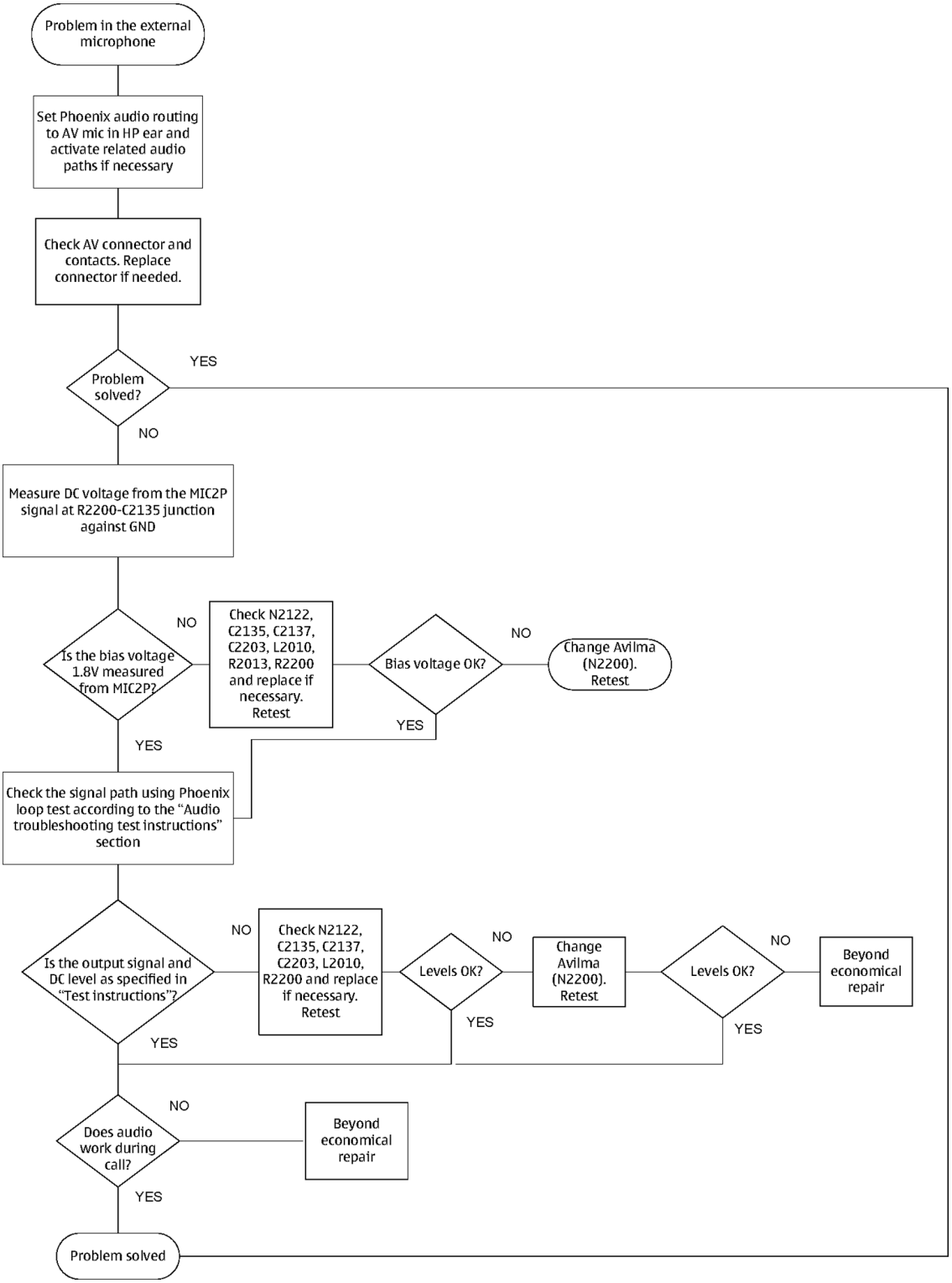
External microphone troubleshooting

Troubleshooting flow



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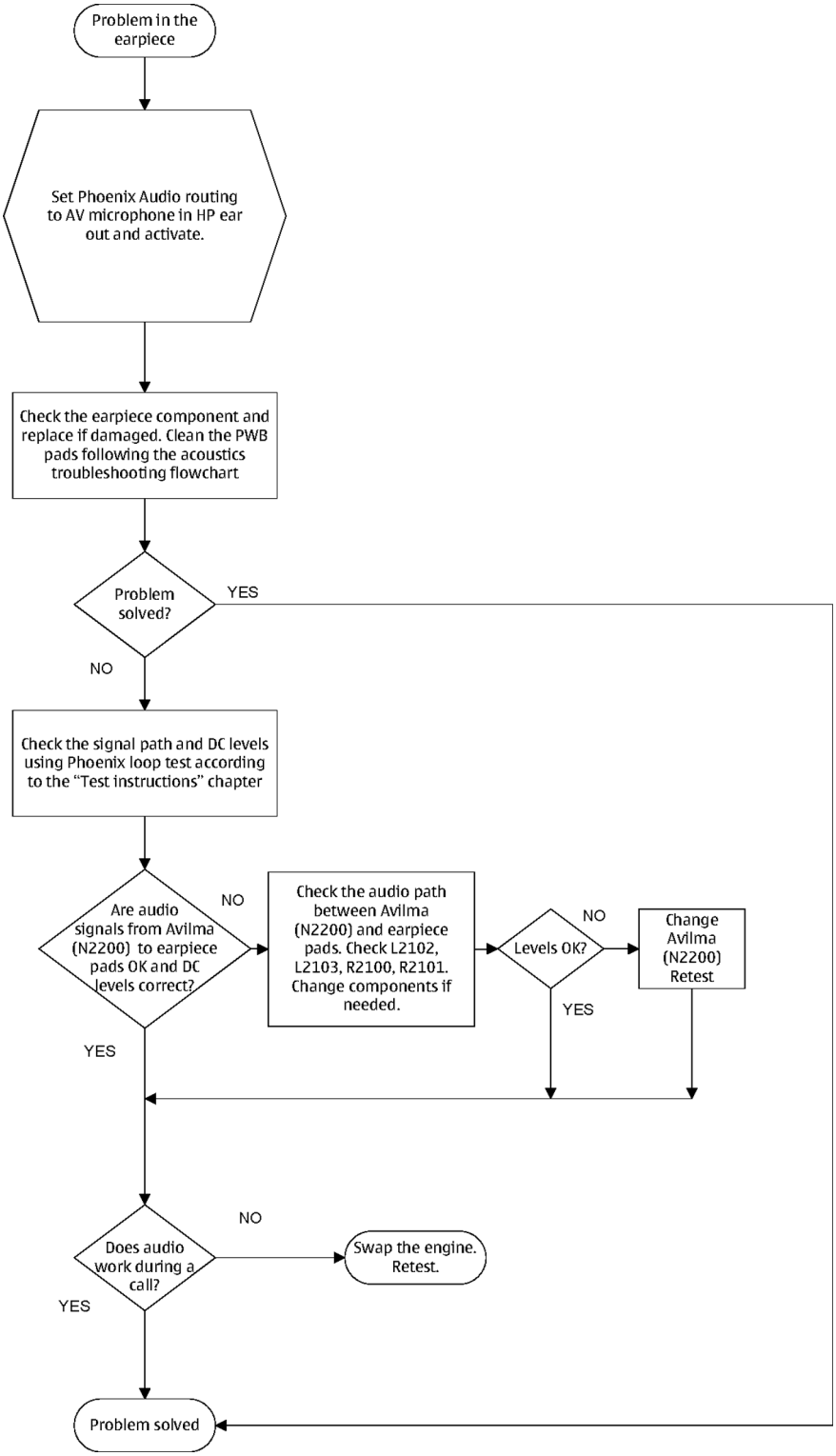
Internal earpiece troubleshooting

Troubleshooting flow



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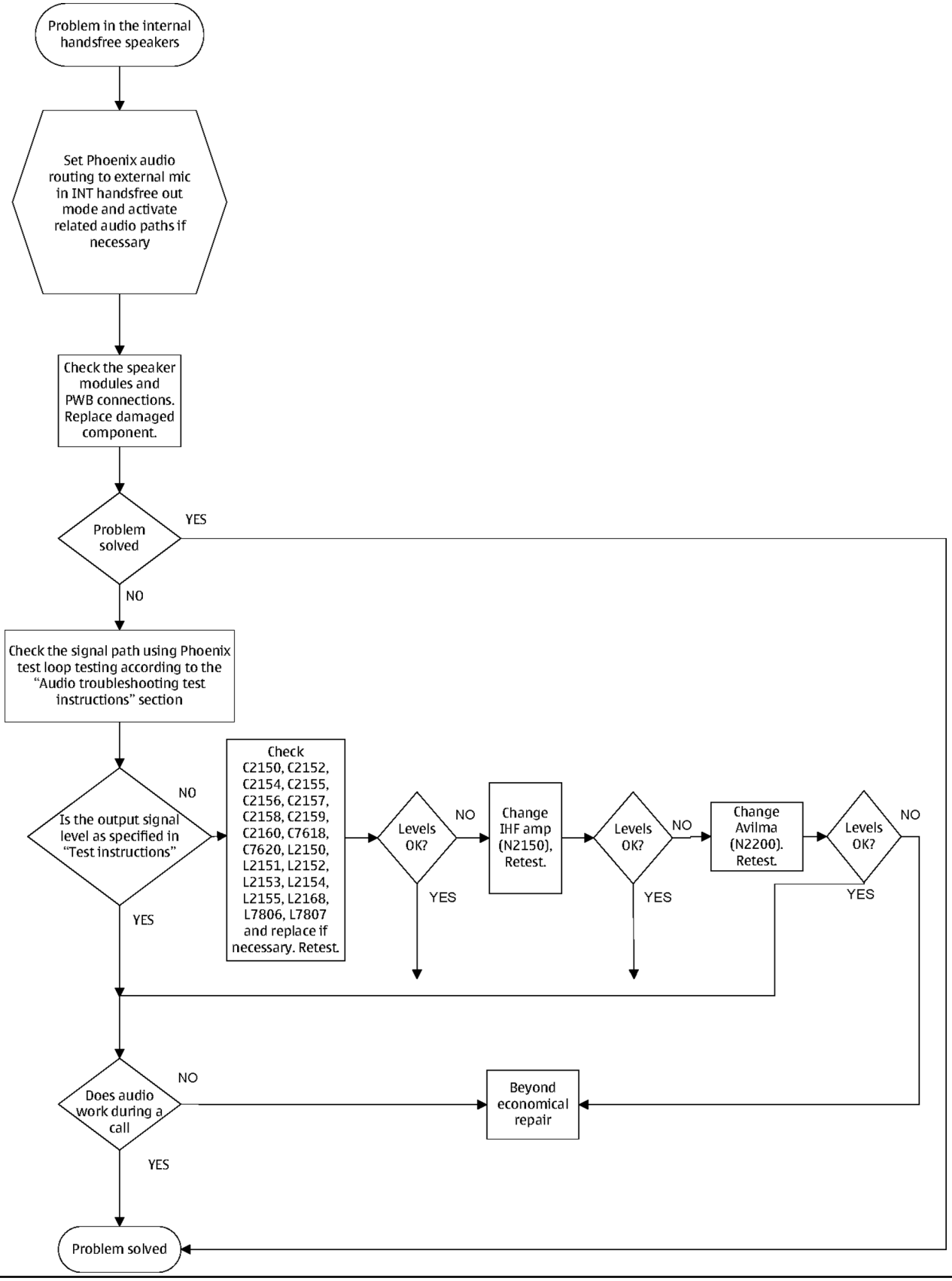
Internal handsfree speaker troubleshooting

Troubleshooting flow



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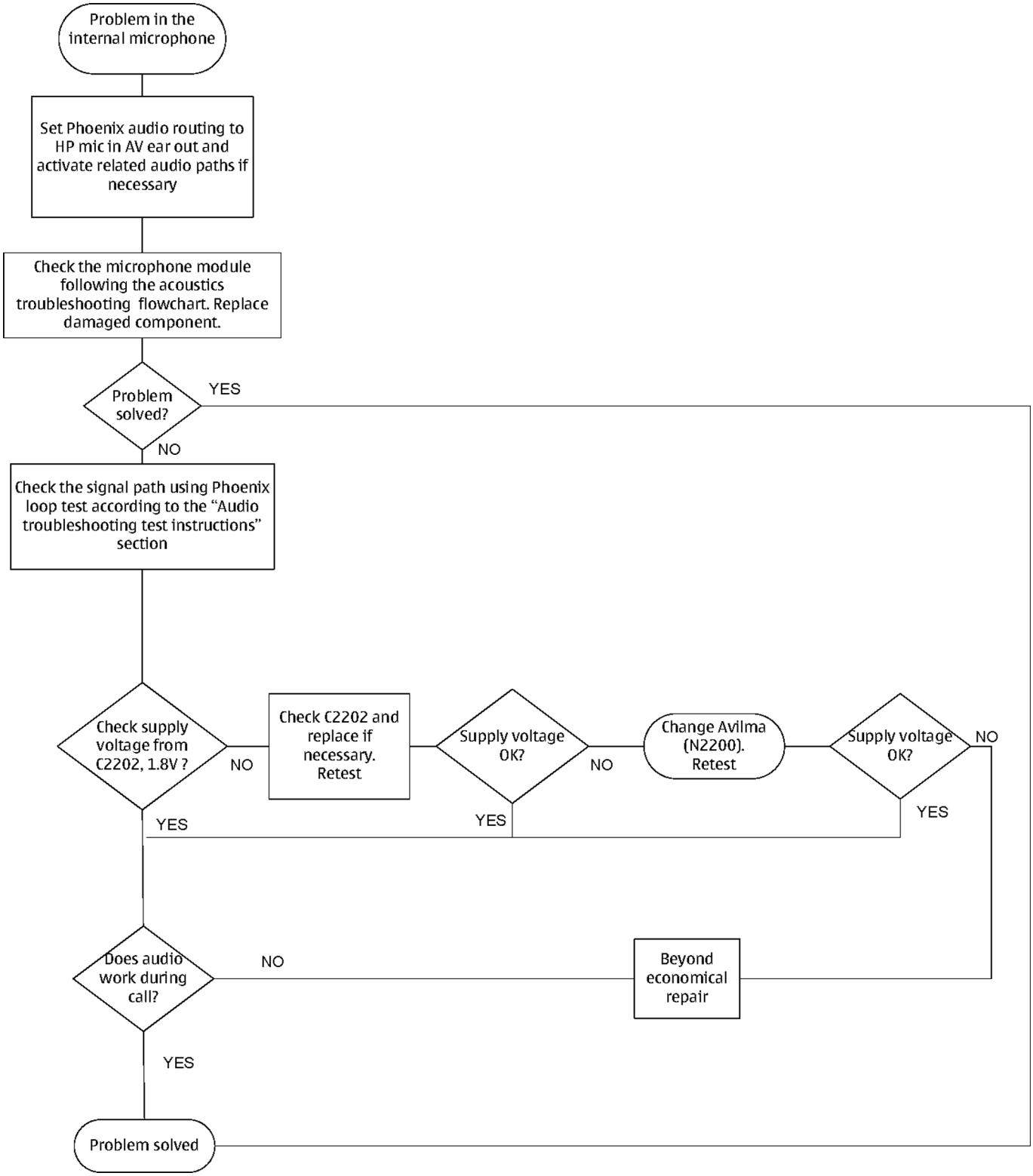
Internal microphone troubleshooting

Troubleshooting flow



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ALS Technical Description and Troubleshooting

Ambient Light Sensor

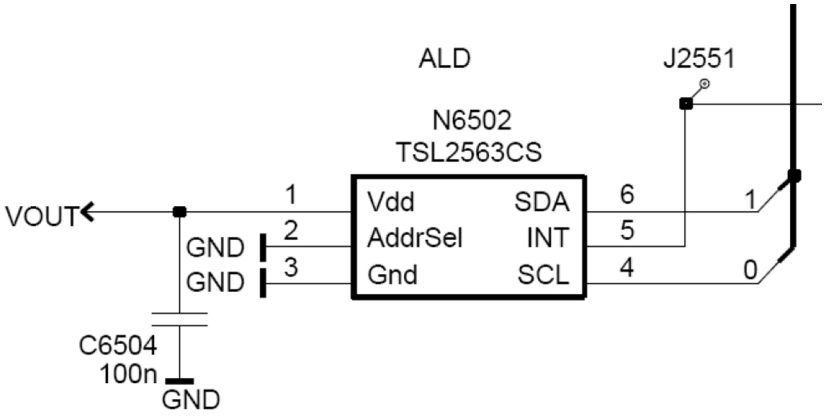

Figure 14 Ambient Light Sensor

Ambient Light Sensor consists of the following components:

- Light guide
- Ambient Light Sensor (ALS)

  ALS is a digital I2C interface component, having two channels with different spectral sensitivities. When combined, the component responds to illuminance similar as human eye.
- Vdd Filtering capacitor C6504

Ambient Light Sensor information is used to control keypad and display brightness of the phone. Keyboard and Display brightness is dimmed, when environment lighting is dark.

Ambient Light Sensor is calibrated in production and can be re-tuned in service points though not recommended unless calibration coefficient are lost for some reason.

ALS troubleshooting

Context

Functionality check:

Steps

1. Connect phone to Phoenix and set the phone (e.g. on the table) so that the amount of ambient light seen by ALS is as stable as possible.
2. Start Phoenix
3. Choose **File -> Scan product**
4. Choose **Testing -> Display Test**
5. Open the **Lights** tab, check Ambient Light Sensor check box, click **Read**, cover the sensor and click **Read** again. When covered, Luminance reading should be less than after clicking **Read** without covering the sensor.

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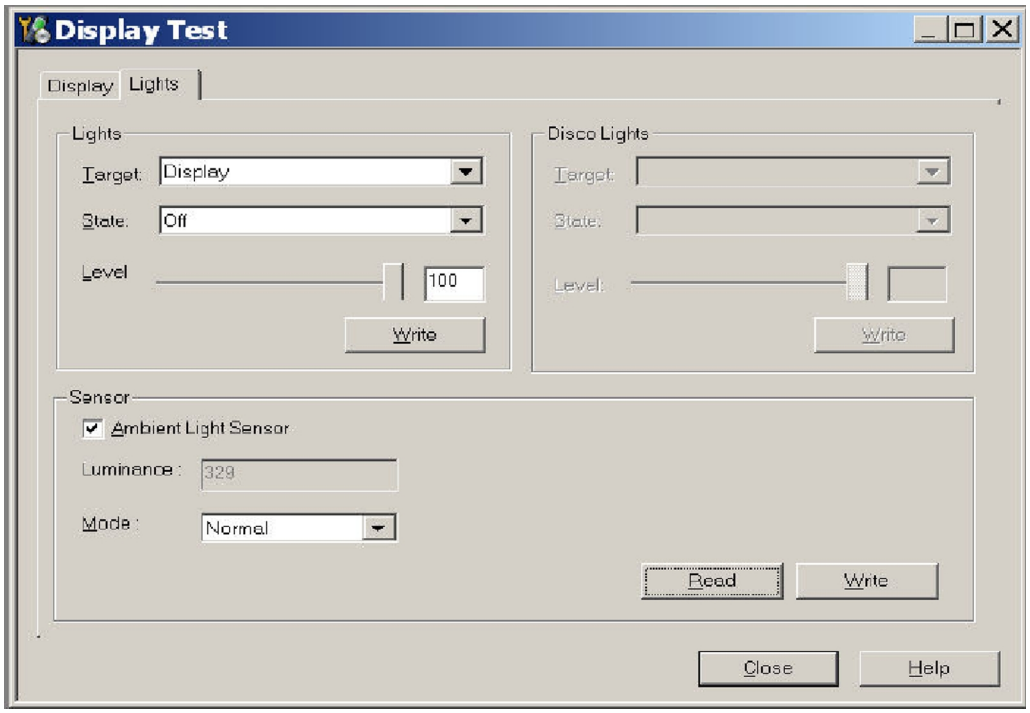
6. If component doesn't give any reading or reading doesn't change when sensor is/is not covered, replace the part.



Note: After replacing the ALS. If calibration values of the new sensor are lost or for some other reason, ALS re-tuning is required (see instructions later in this document).

When doing the ALS calibration procedure, it is required to have a reference phone, which includes calibrated ALS. ALS re-tuning instructions show why the reference phone is needed.

Re-tuning ALS

Steps

1. Connect reference phone to Phoenix and set the phone (e.g. on the table) so that the amount of ambient light seen by ALS is as stable as possible.
2. Start Phoenix.
3. Choose **File→Scan Product.**

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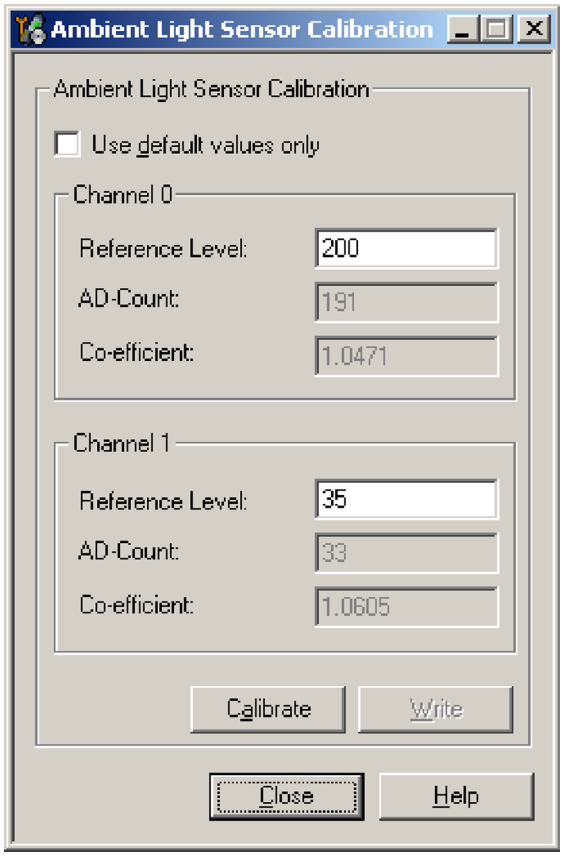
4. Choose **Tuning -> Ambient Light Sensor Calibration**. You should see the following window:



5. Read AD-count values for Channel 0 and Channel 1 by click **Read** button and write them down.
6. Repeat 1-5 for the phone to be calibrated and make sure the phone to be calibrated is located in the same place as reference phone was when luminance reading was taken.
7. Calculate co-efficient from reference phone and phone to be calibrated AD-count values by division: Co-efficient = AD-count(reference phone) / AD-count(phone to be calibrated), write down the calculated co-efficient values.
8. -> Iterate by changing Channel 0 and Channel 1 (reference level) values (remove cross from 'Use default values only'). After writing some value to Channel 0 and Channel 1 (reference value), calibrate button must be pressed. Stop iterating when Co-efficient is equal to Co-efficient calculated in step 7. Note that decimal numbers should be used in the iteration in order to achieve enough precision (e.g. 200.2455)
9. After having same Co-efficient value in "Co-efficient" textbox as the calculated value, make sure that ambient light values (read using **Testing → Display Test → "Luminance"** textbox) are almost the same in reference phone and calibrated phone. Remember that illuminance readings for reference and calibrated phones must be done in the same ambient light conditions. If illuminance values differs a lot (difference max. +- 10%), repeat whole ALS re-tuning procedure.
10. To end the calibration, click Close.

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Bluetooth and FM Radio Troubleshooting

Introduction to Bluetooth/FM radio troubleshooting

Bluetooth/WLAN/GPS antenna

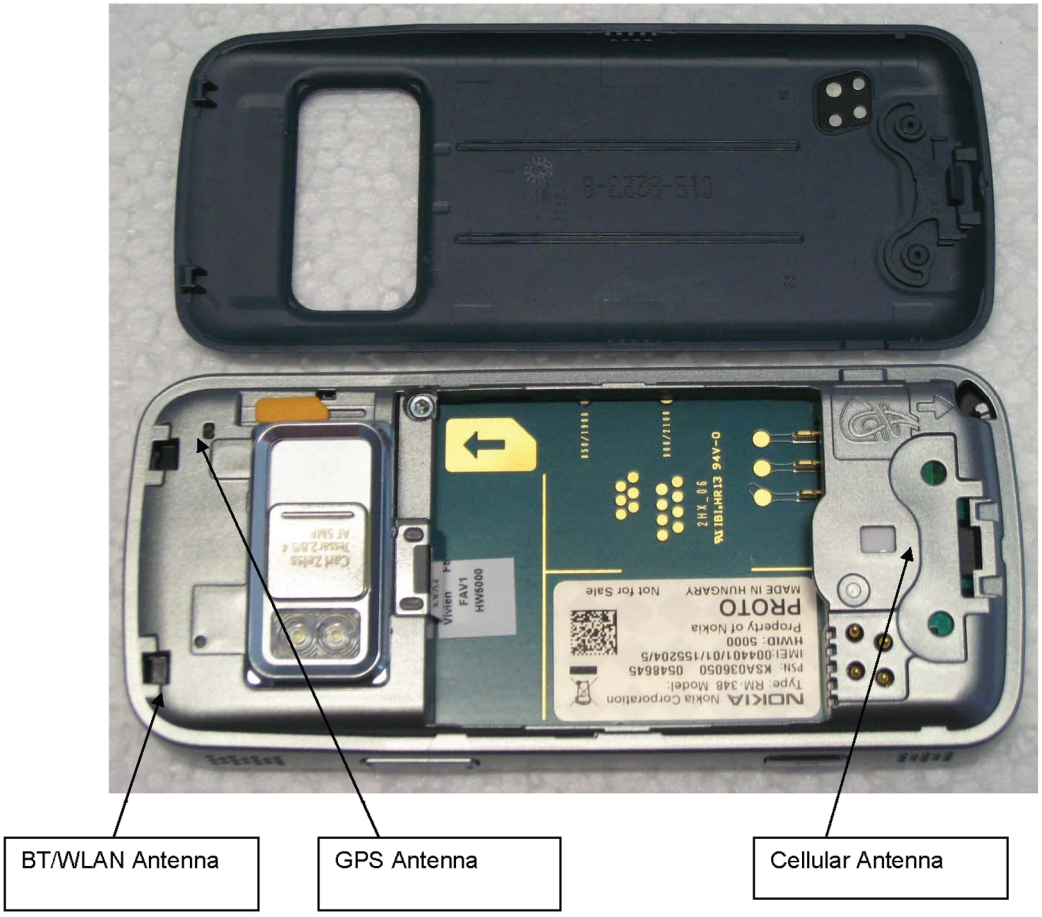

Figure 15 Bluetooth/WLAN and GPS antenna in B-cover

The BT RF signal is routed from BTFMRDS2.0 through the WLAN module to the shared WLAN/BT antenna in the phone's B-cover. The WLAN RF signal is routed from the WLAN module to the shared WLAN/BT antenna in the phone's B-cover. The GPS signal is routed from the GPS antenna into the GPS chip.

Bluetooth/FM radio troubleshooting

The Bluetooth and FM radio are combined in the same ASIC, so both features are checked when troubleshooting.

The following problems can occur with the Bluetooth and FM radio hardware:

Symptom	Problem	Repair solution
Unable to switch on Bluetooth on phone user interface	Open circuit solder joints or component failure of BTH/FM ASIC/module BB ASICs or SMD components.	Replacement of Bluetooth/ FM ASIC/module

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Symptom	Problem	Repair solution
Able to send data file to another Bluetooth device, but unable to hear audio through functional Bluetooth headset	Open circuit solder joints or component failure of BTH/FM ASIC/module BB ASICs.	Replacement of Bluetooth/ FM ASIC/module
Able to switch on Bluetooth on phone user interface, but unable to detect other Bluetooth devices	Open circuit solder joints or Pogo Pins not making contact with c-cover	Repair or replace c-cover
Able to turn on FM radio and Bluetooth on phone user interface, but unable to detect local FM radio stations with Nokia headset inserted	Open circuit solder joints or detached component in FM antenna circuit	Repair of FM antenna connection or FM circuit component
Able to perform scans to detect local FM radio stations with functional Nokia headset inserted, but unable to hear FM audio through headset	Open circuit solder joints or detached component in FM audio path between Bluetooth/ FM ASIC and headset	Repair of FM audio circuit

Users may experience the following problems resulting in functional phones being returned to the repair centre:

Symptom	Problem	Repair solution
Bluetooth feature does not operate as desired with another Bluetooth device	Bluetooth Profile implemented in Bluetooth accessory not supported in Nokia phone	Use Bluetooth accessory with Bluetooth profiles supported by phone
Poor FM radio reception (unable to detect many radio stations)	Nokia headset not being used	Use Nokia headset

Test coverage

The tests listed in the table below should be performed to verify whether the Bluetooth and FM receiver and transmitter are functional. The use of Self Tests are described in section *BT and FM Self Tests in Phoenix*

Test	Test Coverage	Repair solution
Blueooth Self Test: ST_LPRF_IF_TEST	Bluetooth-FM ASIC UART interface (controls Bluetooth and FM receiver and transmitter)	Replacement of Bluetooth/FM ASIC (or repair of phone BB)
Bluetooth Self Test: ST_BT_WAKEUP_TEST	Bluetooth ASIC interrupt control interface	Replacement of Bluetooth/FM ASIC (or repair of phone BB)
Bluetooth Self Test: ST_LPRF_AUDIO_LINES_TEST	Bluetooth ASIC PCM interface	Replacement of Bluetooth/FM ASIC (or repair of phone BB)
Bluetooth Functional Test: BER test with BT-Box or functional test with other Bluetooth device	Bluetooth antenna circuit	Repair of Bluetooth antenna circuit (including RF filter or WLAN switch if fitted)
FM Radio Self Test: ST_RADIO_TEST	FM Radio I2C interface	Replacement of Bluetooth/FM ASIC (or repair of phone BB)

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Test	Test Coverage	Repair solution
FM Radio Functional Test: Perform scan for local radio stations and check station list displayed on phone	FM receiver antenna circuit	Repair of FM antenna circuit (between BTHFM ASIC and headset connector)
FM Radio Functional Test: Listen to local radio station	FM receiver audio circuit	Repair of FM receiver audio circuit (between BTHFM ASIC and headset connector)

The self tests run from Phoenix software are used for fault diagnosis.

If Phoenix software is not available the functional tests with phone accessories are sufficient to verify the functionality Bluetooth and FM radio receiver and transmitter.

Bluetooth/FM radio component layout and test points

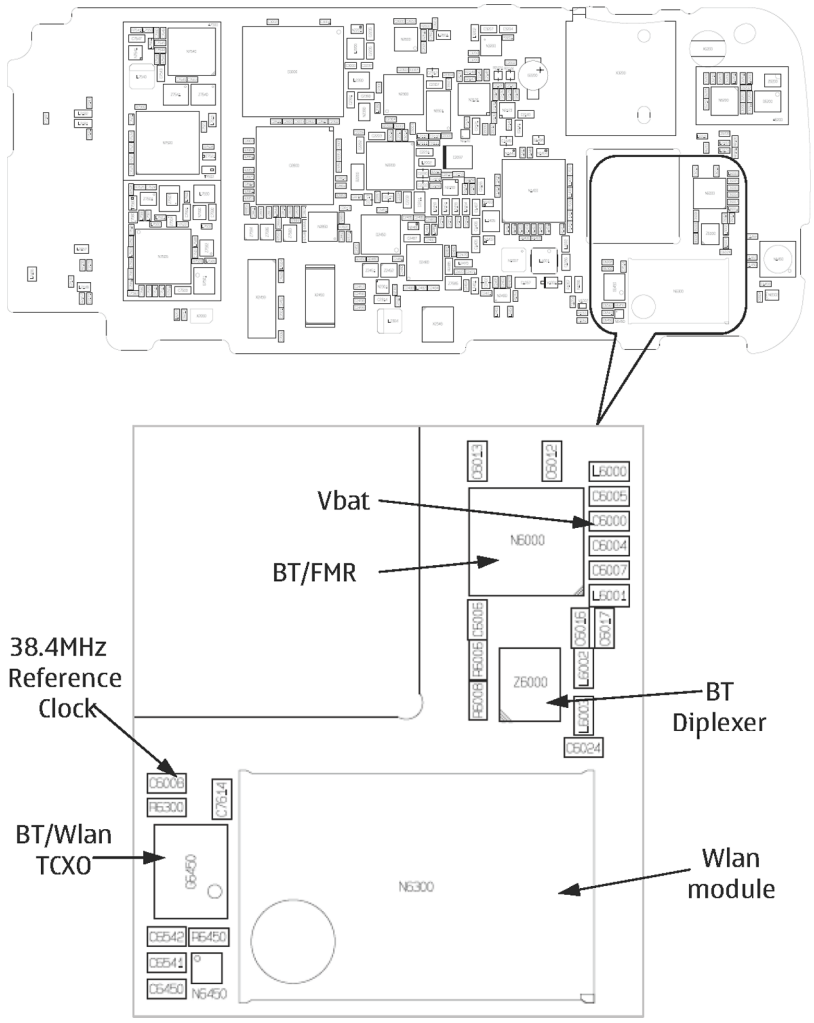

Figure 16 Bluetooth/FM Radio, WLAN component layout and test points

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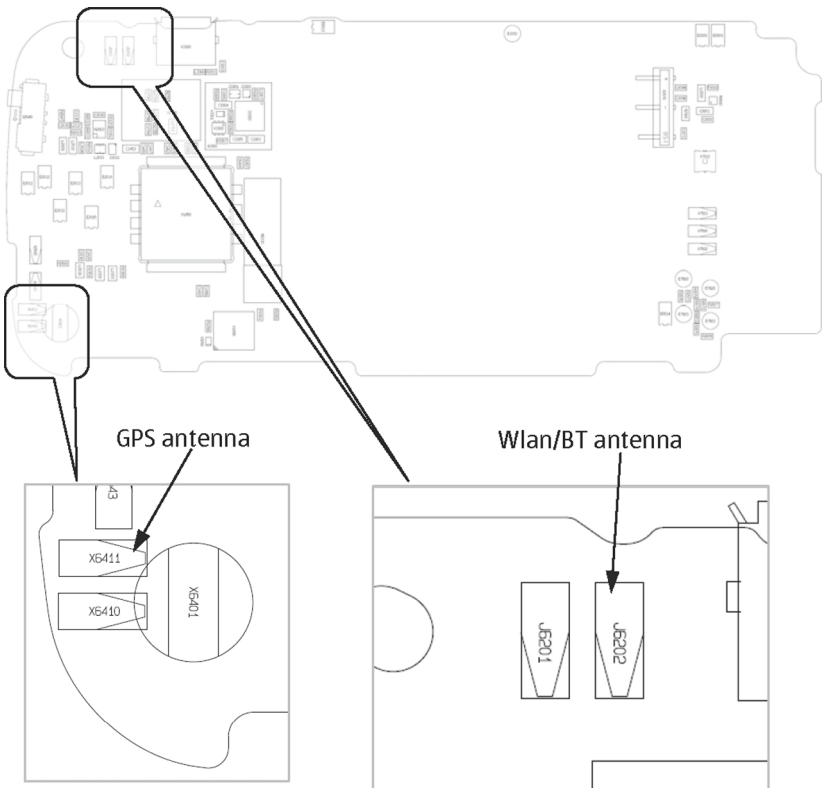

Figure 17 WLAN/BT and GPS antenna pads

The Bluetooth antenna is product specific (antenna integrated into phone C cover). On phones with WLAN, the Bluetooth RF signal is routed through a WLAN front-end module and a shared Bluetooth / WLAN antenna is used. The FM RF signal is routed through a product specific FM antenna matching circuit to the phone headset connector. The FM radio audio signal is routed to the headset connector through the BB ASIC shared by the phone audio functions.

Bluetooth BER test

Prerequisites

JBT-9, or SB-6 Bluetooth test box (BT-box) is required to perform a BER test. If a BT-box not available Bluetooth functionality can be checked by transferring a file to another Bluetooth phone. For the BER or file transfer test the C-cover should be fitted as the BT antenna is on the C-cover.

Steps

1. Connect data cable to phone.
2. Start *Phoenix* service software.
3. Choose **File** → **Scan Product**.
4. Choose **Testing** → **Bluetooth LOCALS** .
5. Locate the BT-box serial number (12 digits) found in the type label on the back of the JBT-9, or SB-6 Bluetooth test box.
6. In the Bluetooth *LOCALS* window, write the 12-digit serial number on the *Counterpart BT Device Address* line.
7. Place the BT-box near (within 10 cm) of the phone and click **Start BER Test**.

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Bluetooth and FM radio self tests in Phoenix

Prerequisites

A flash adapter (or phone data cable) connected to a PC with Phoenix service software is required.

Steps

1. Place the phone in the flash adapter or connect data cable to phone.
2. Start *Phoenix* service software.
3. Choose **File→Scan Product.**
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing→Self Tests.**
6. In the *Self Tests* window check the following Bluetooth and FM radio related tests:
   - **ST_LPRF_IF_TEST**
   - **ST_LPRF_AUDIO_LINES_TEST**
   - **ST_BT_WAKEUP_TEST**
   - **ST_RADIO_TEST**
7. To run the tests, click **Start**.

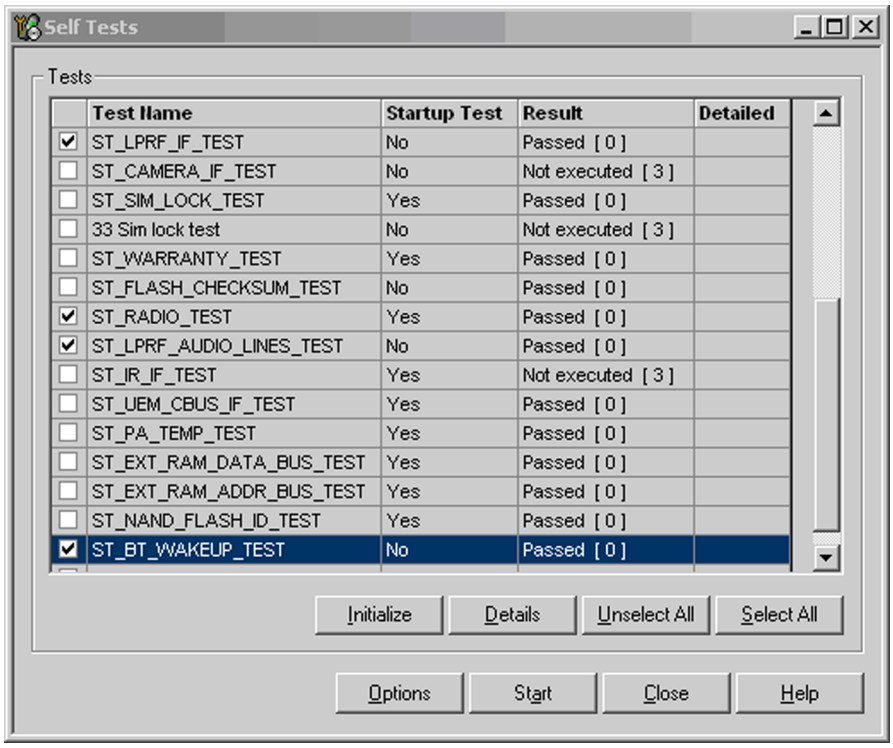

Figure 18 Bluetooth and FM radio self tests in *Phoenix*

FM radio testing

Steps

1. Set signal generator parameters:
   - FM modulation on
   - Frequency 100MHz

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- FM deviation 22kHz
- Modulation frequency 1kHz
- RF level should be varied during the test to obtain good audio signal quality
- Connect suitable antenna to signal generator

  Note: You may alternately use a known good FM radio broadcast as a test signal.

2. Attach the Nokia headset to the phone's AV connector.
3. Use Scroll button to autotune to the radio frequency.
4. Set volume to suitable level.
5. Check audio quality with a headset.

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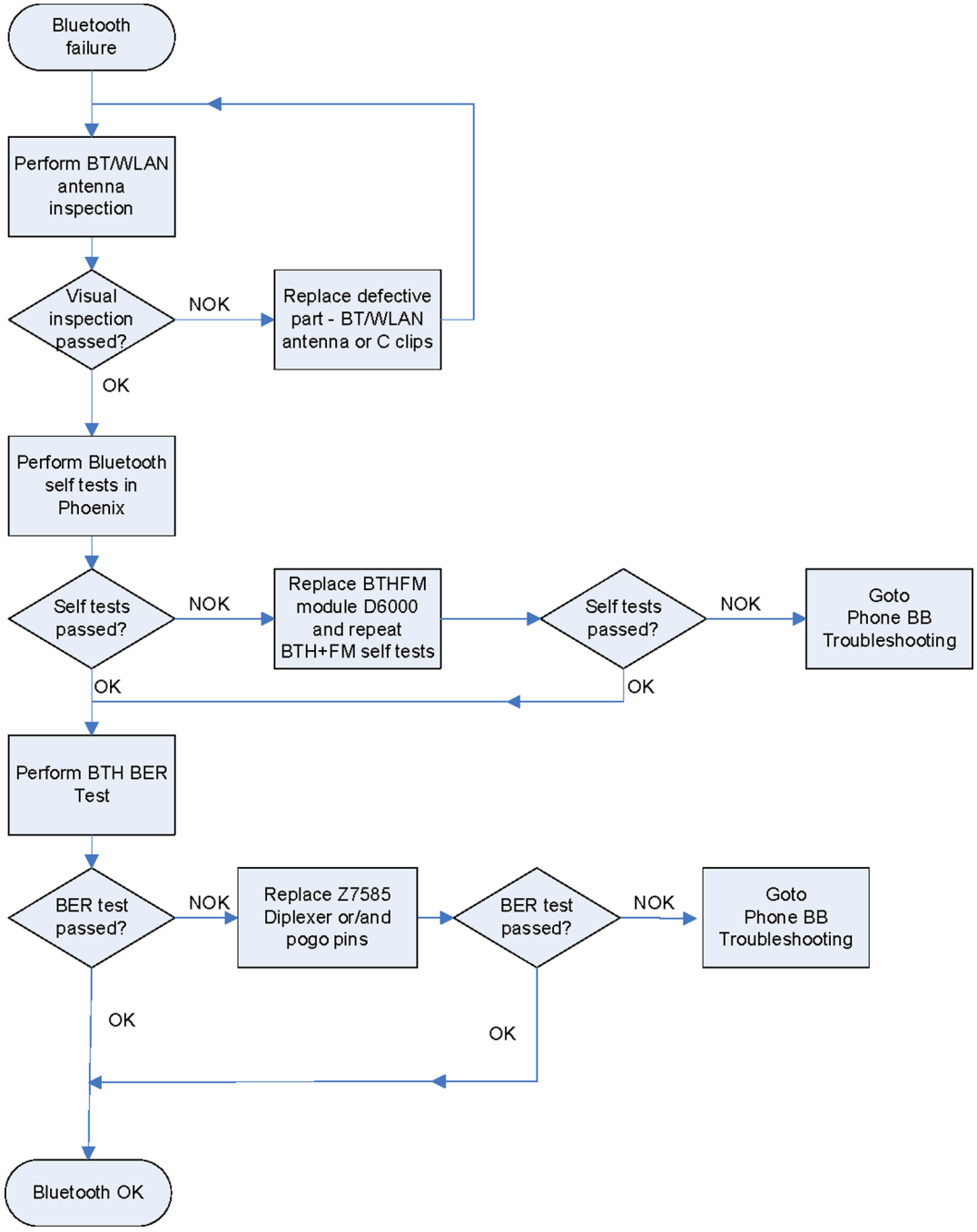
Bluetooth troubleshooting

Troubleshooting flow



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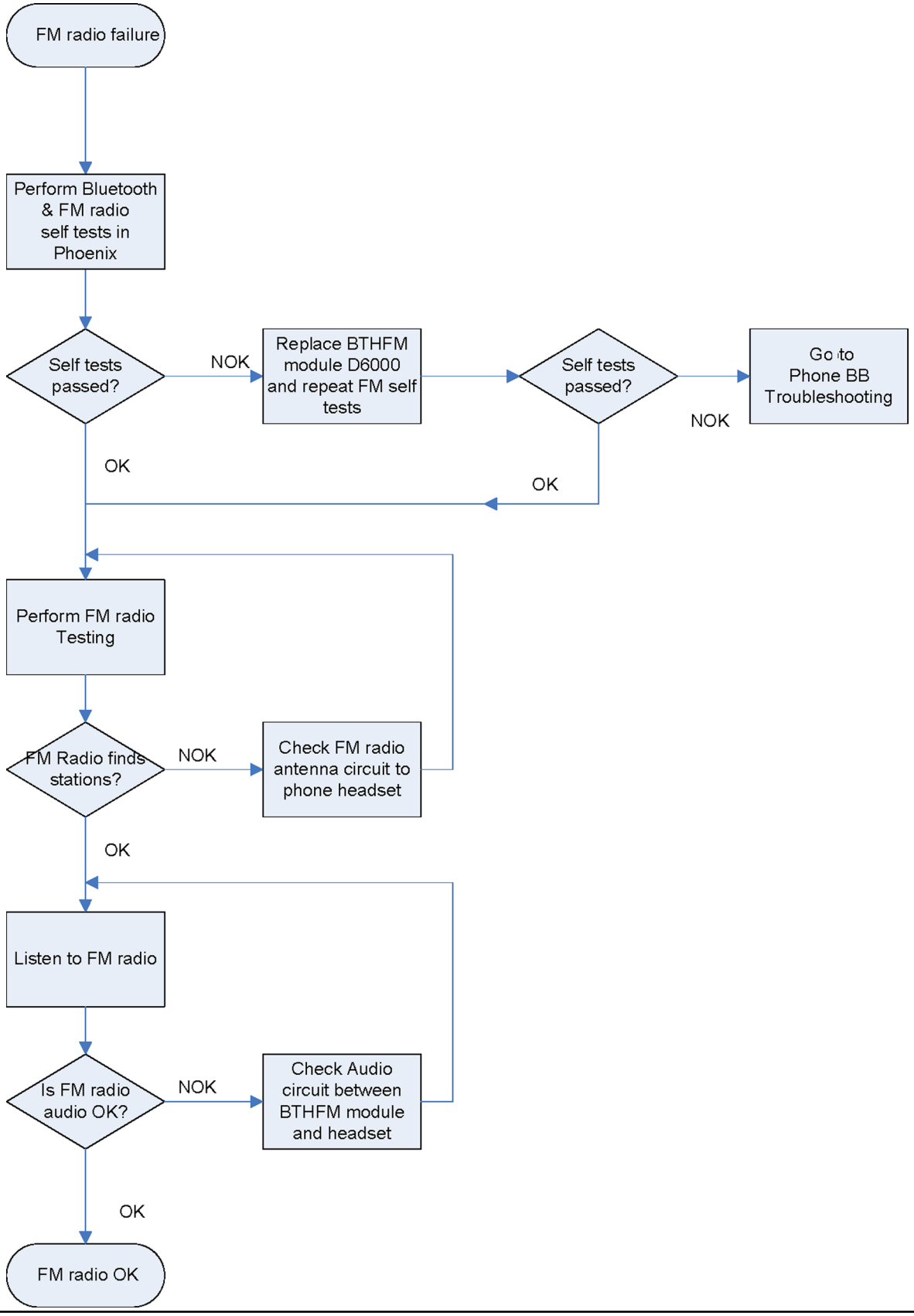
FM radio troubleshooting

Troubleshooting flow



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GPS Troubleshooting

GPS layout and basic test points

The GPS components are located under the shield can A6200. Satellite signals are picked up by the phone's GPS antenna in the B-cover. The signal is then routed through a filter before being processed by the GPS5350 receiver ASIC.

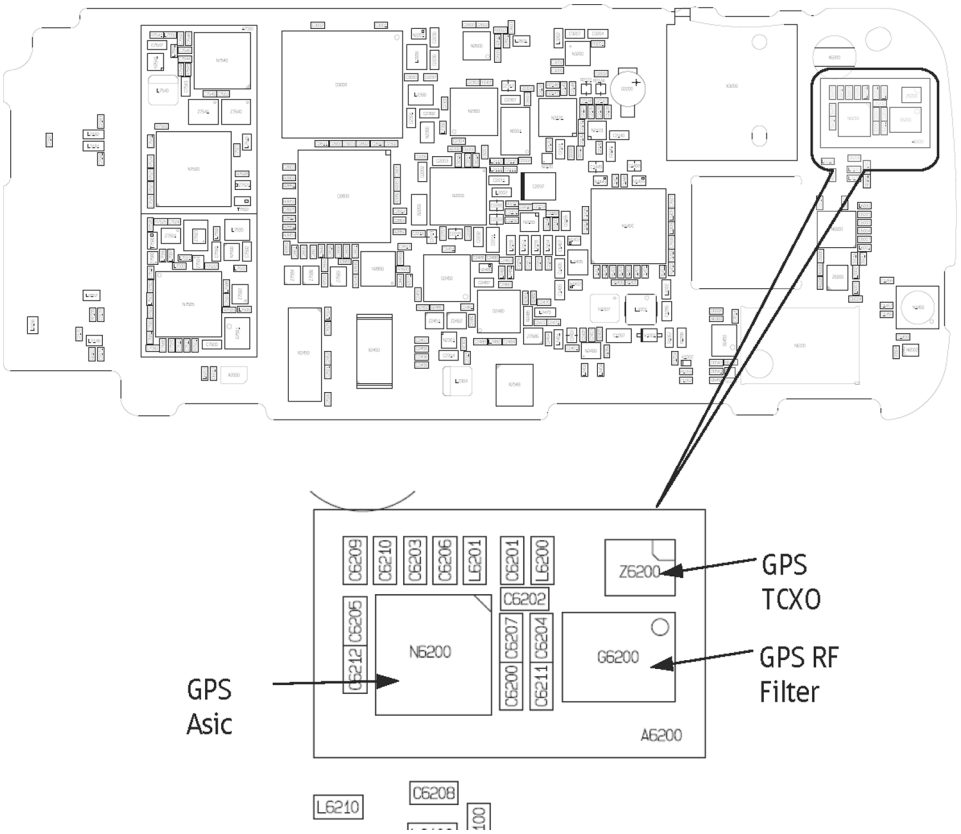

Figure 19 GPS layout and basic test points

GPS Settings for Phoenix

GPS control

Prerequisites

A flash adapter with RF coupler connected to a PC with Phoenix service software is required. The GPS signal should be connected to the RF coupler. Calibrate the signal level with a known good phone. Signal level will be high (approx -45dBm) because it is a leakage connection.

Context

Use the following to test GPS using Phoenix.

Steps

1. Place phone to Flash Adaptor.
2. Start Phoenix service software.
3. From the **File** menu, select **Scan Product** and check that the correct product version is displayed.

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4. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box, as shown in the figure below, and enables the GPS.

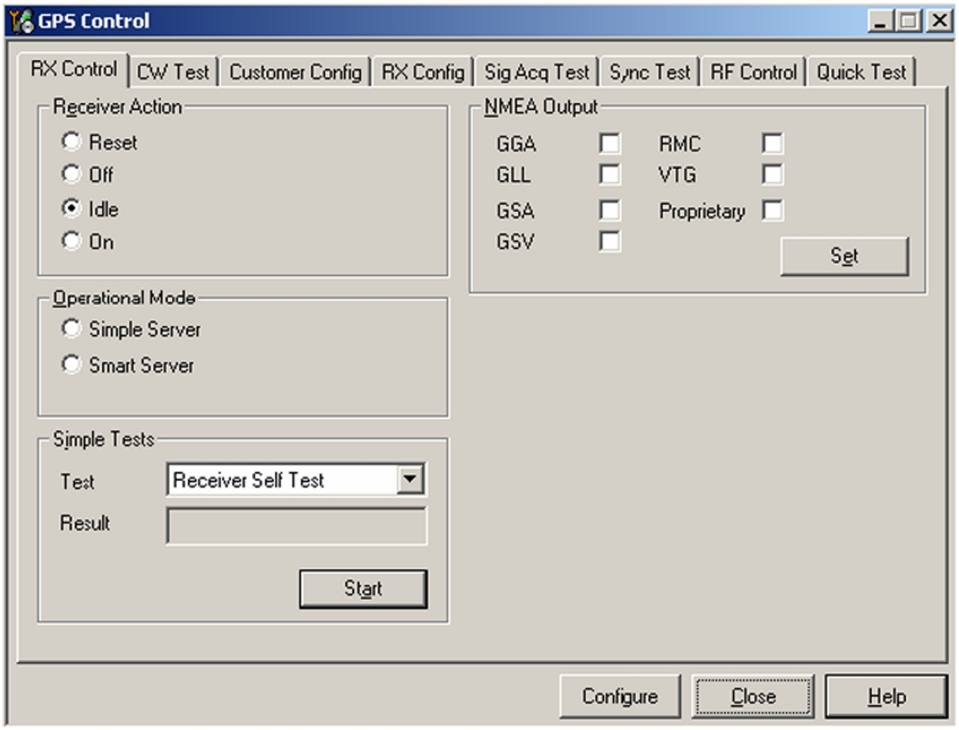

Figure 20 GPS Control dialogue box

Select **Idle** to confirm the GPS is enabled and is in idle mode; at this point all clocks should be present, GPS_En_Reset & SleepX should be high, and Vdd_Dig, Vcc_TCXO & Vcc_PLL/VCO will be present.

Receiver On turns on all RF sections of the ASIC and so all LDOs will be on.

Quick Test window

This test will perform 3 tests in one: Self test, Oscillator Test and CW Test and will provide a Pass/Fail Response for each. The HW Self Test confirms basic communication with the GPS ASIC. The oscillator test confirms the frequency accuracy of the GPS TCXO against the Ref_Clk. The CW Test confirms end-to-end connectivity between the GPS antenna pogo pins and the GPS ASIC. It also contains a receive button.

Before this test is performed a known reference phone should be tested in order to calibrate the setup. The signal level of the Signal Generator should be adjusted so a reading of SNR 40 dB is achieved with the reference unit. A good starting point is to set up the signal generator to -45dBm.

These checks are part of GPS failure troubleshooting (page 3–50).

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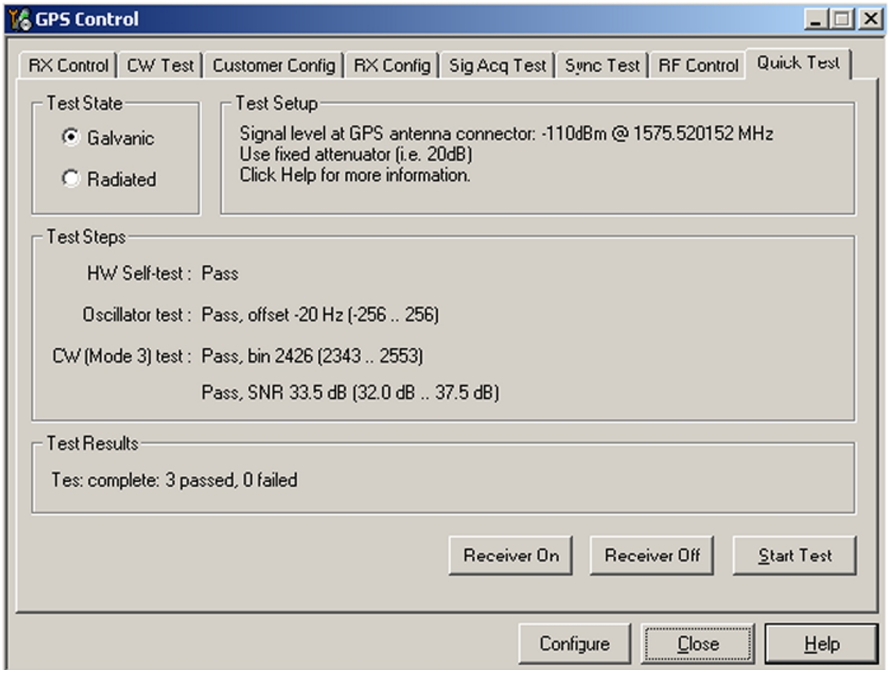

Figure 21 GPS Quick Test window

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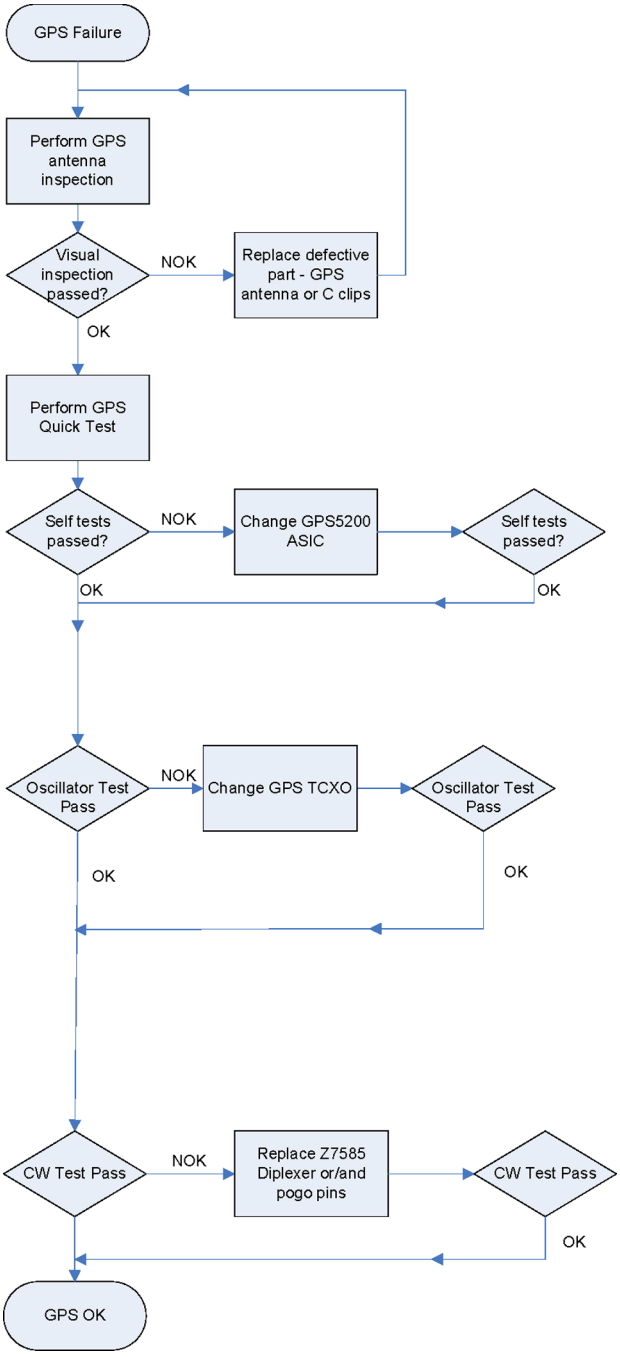
GPS failure troubleshooting

Troubleshooting flow



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WLAN Troubleshooting

WLAN component layout and test points

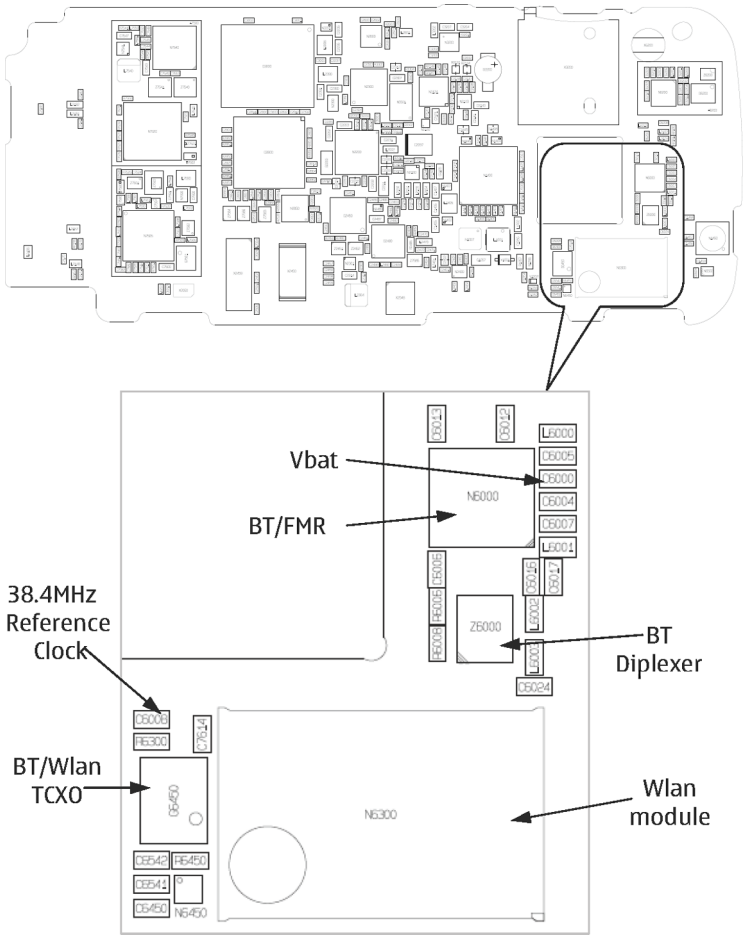

Figure 22 WLAN component layout and test points

The WLAN RF signal is routed from the WLAN module to the shared WLAN/BT antenna in the phone's B-cover.

WLAN selftest and coexistence test in Phoenix

Prerequisites

Connect complete phone assembly to a PC with Phoenix service software using a USB data cable.

Use the following to test WLAN using Phoenix:

1 Set phone into Local Mode .

2 From the **File** menu, select **Scan Product** and check that the correct product version is displayed

3 From the **Testing** menu, select **Self Test**. This opens up a Self Test dialogue box, as shown below.

Select the **ST_WLAN_TEST** check box as shown and then select **Start** button. The test turns on the WLAN, sets up the SPI interface and then downloads the WLAN firmware into the WLAN module. During the download the WLAN acknowledges the data blocks and so the self test is a good way to confirm that the WLAN module is communicating with the Host. The result column will change to **Passed** after a few seconds if operating properly.

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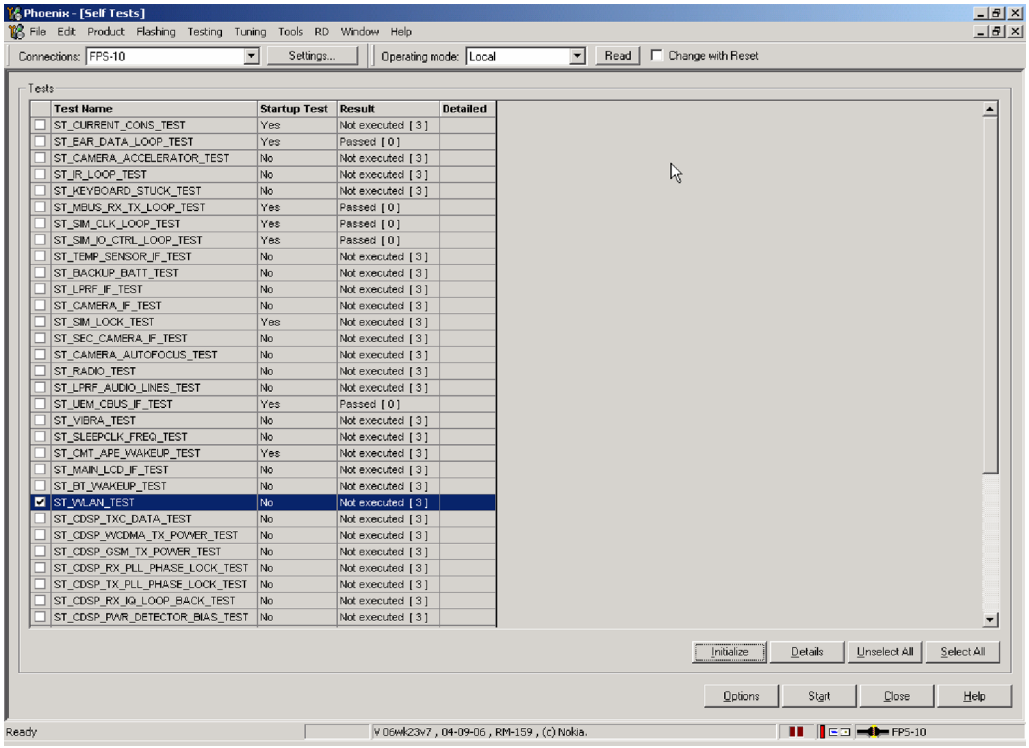
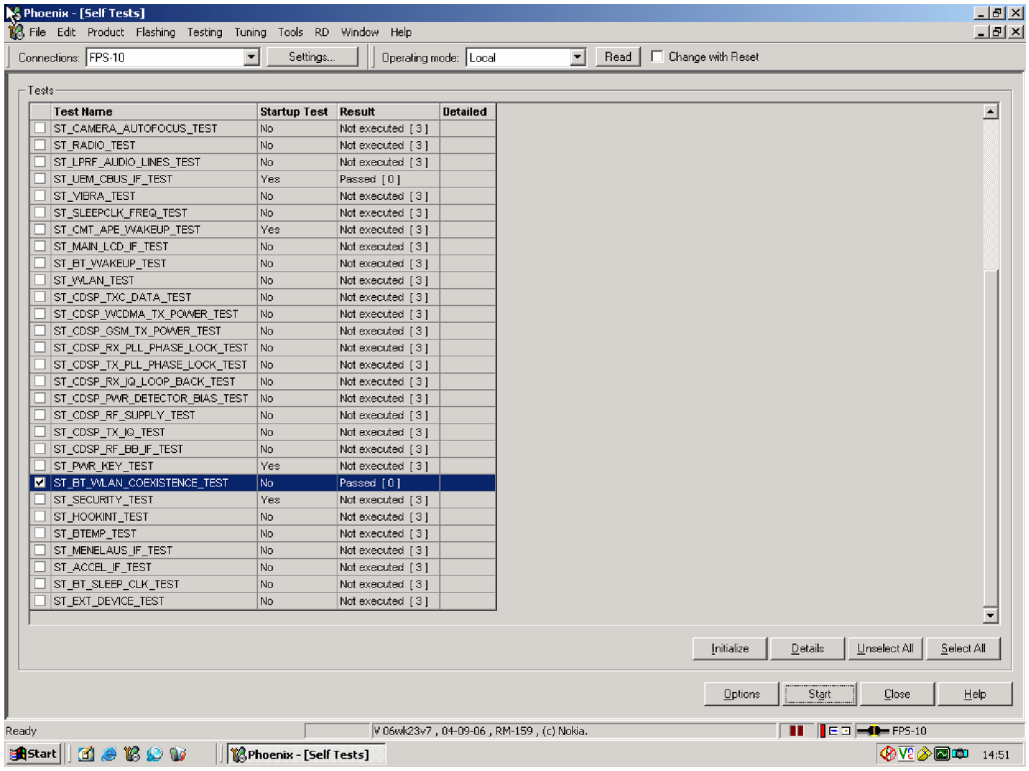


In addition, a test of the WLAN to BTH interface can be done by selecting the **ST_BT_WLAN_COEXISTENCE_TEST** check box and selecting Start button.

This test verifies that the WLAN to BTH co-existence interface signals are properly connected and there are no open circuit or shorts on the four interface signals.

The co-existence interface comprises BTH Txconfig, BTH RF Active, BTH Priority, and BTH Frequency.



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In summary these two Self tests provide a simple means of ensuring the Host engine is able to communicate with the WLAN module and check the interface to BTH. More detailed WLAN performance test is covered in WLAN functional test section.

WLAN functional tests

On/Off test

Prerequisites

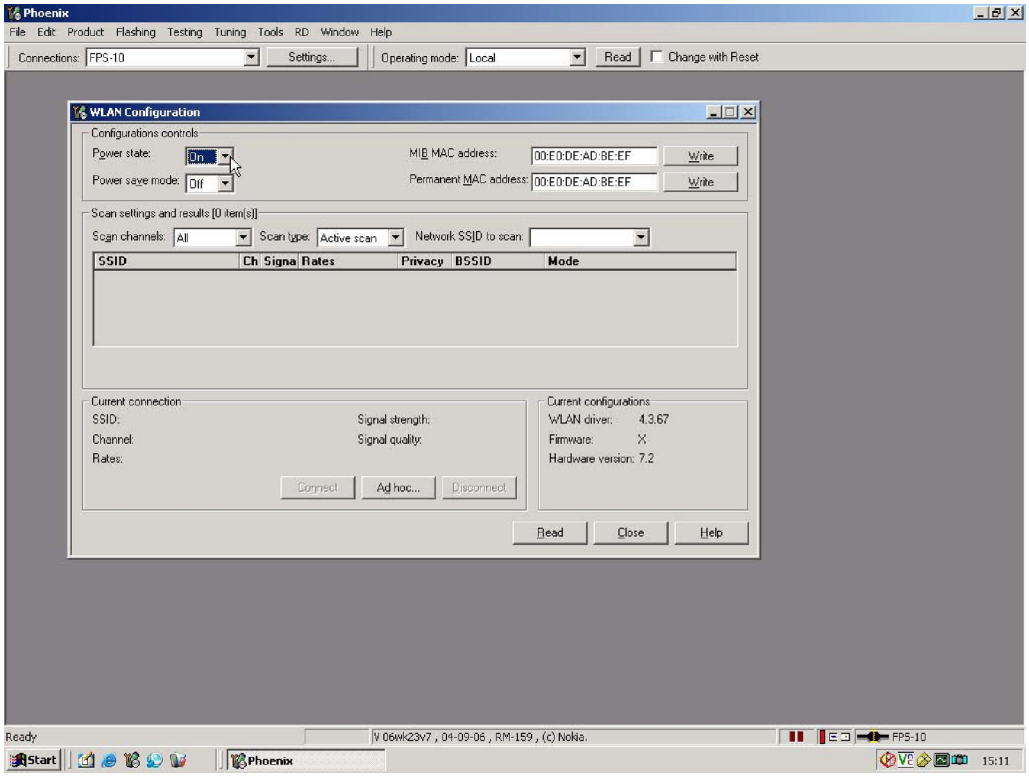
A flash adapter connected to a PC with Phoenix service software is required.

From the testing toolbar select **WLAN Configuration** option. This opens the WLAN configuration dialogue box below. Selecting the Power state option button (as indicated), the WLAN can be turned ON and OFF:

1 With Power State set to OFF, measure the dc power supply current consumption of the flash adaptor.

2 Next return the Power state to ON and re-measure the dc power supply current of the flash adaptor.

The difference between the currents in (1) and (2) should be between 190 to 220mA. When WLAN is ON, the firmware has been downloaded and the WLAN module is in the receive state. When OFF WLAN is powered down.



TX tests

Prerequisites

Connect complete phone assembly to a PC with Phoenix service software using a USB data cable.

From the testing toolbar select WLAN Tx Test option shown below. This test can be used to verify TX configuration and functionality. The default settings are sufficient for testing the TX operation, although other channels and data rates are equally suitable. To start the test, select the Start option button:

1 Monitor the WLAN TX spectrum on a Spectrum analyser. (When making a radiated test ensure that other WLAN devices are not transmitting as these may be detected as well, confusing the result). A typical 11MBPS TX spectrum is shown in figure below.

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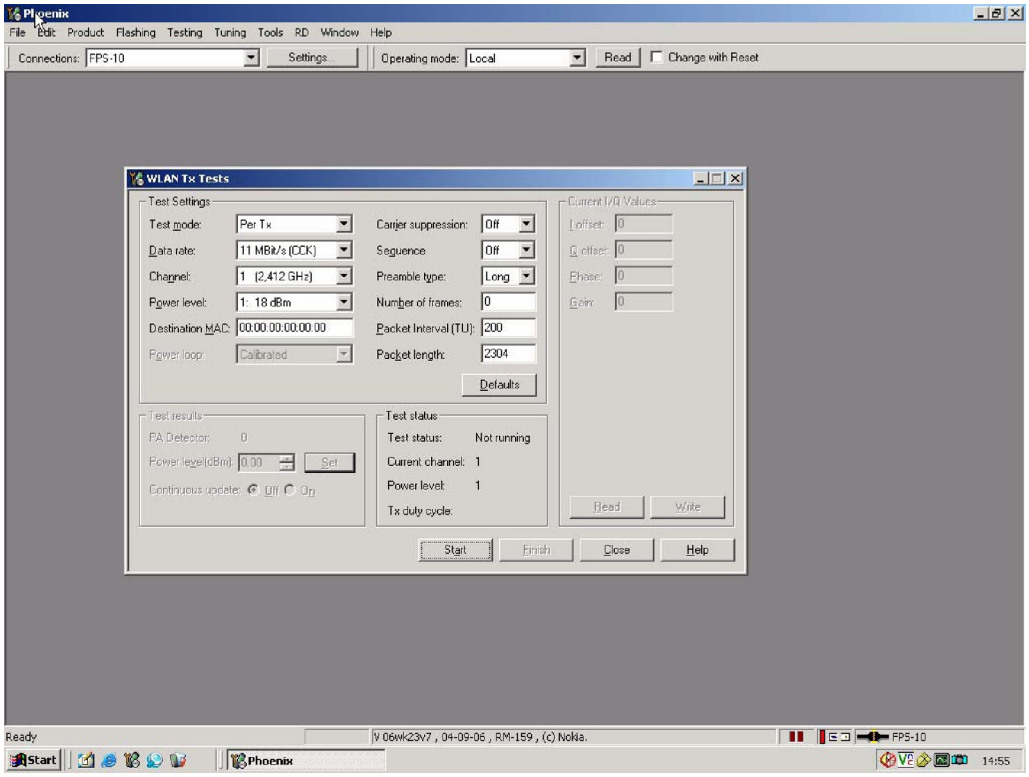
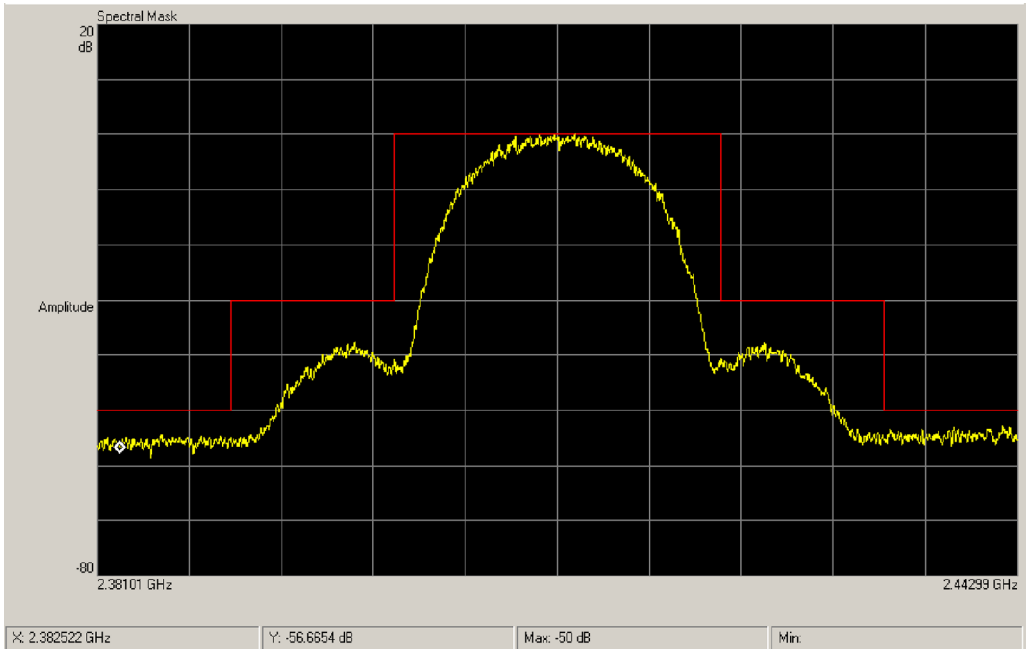
2 To finish the test select the Finish option button.

The difference between the two readings should be approximately 150mA and measures the transmit current in 11MBPS, 802.11b mode of operation.





RX Tests

Prerequisites

Connect complete phone assembly to a PC with Phoenix service software using a USB data cable.

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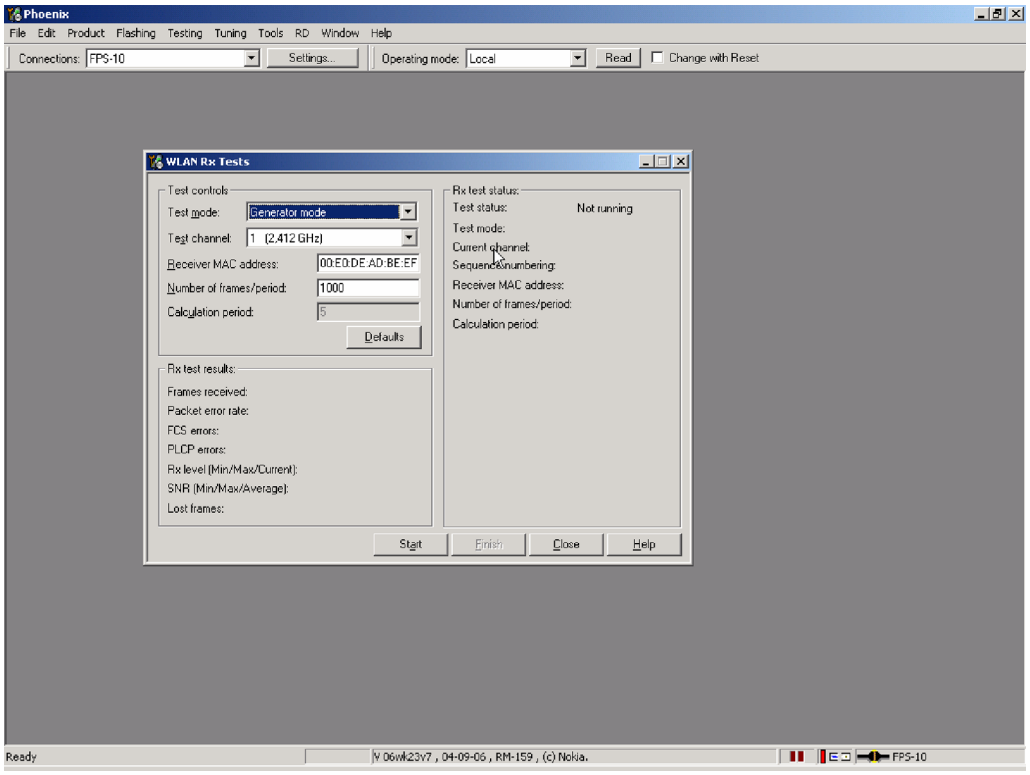
There are different options available for testing the Rx path. The simplest is to use the WLAN to report Rx packets when operating in an area where there is an active WLAN network. Simply starting an Rx test will show the number of packets detected by the WLAN module as it monitors the network. However, it does require a properly configured WLAN network.

From the testing toolbar select WLAN Rx Test option shown below. This test can be used to verify Rx configuration and functionality.

To start the test, select the Start option button.

As the WLAN monitors an active WLAN network, the Rx test results window will update and show the number of Frames received, as well as the Packer error rate.

Monitoring the detected frames is a simple method to verify the WLAN antenna and receiver path is working properly.



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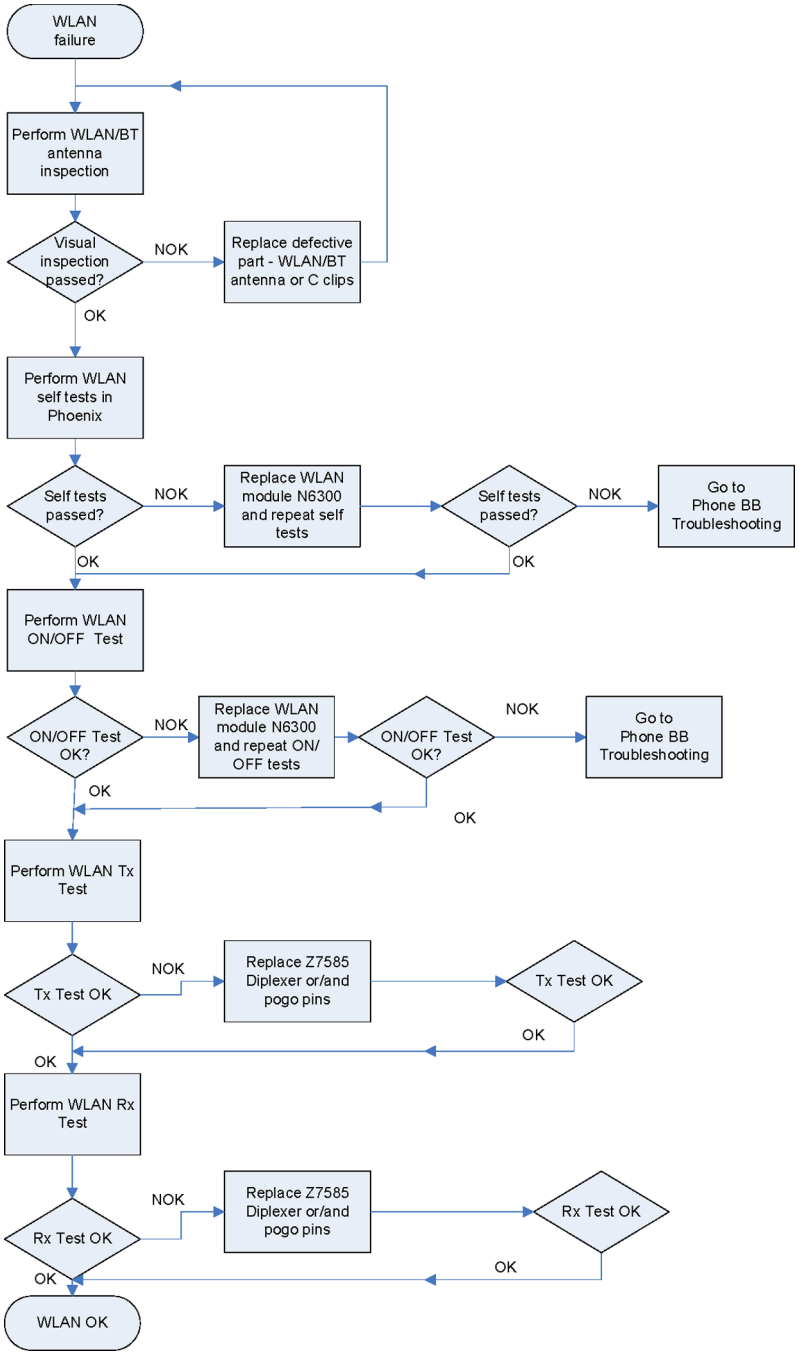
WLAN failure troubleshooting

Troubleshooting flow



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4 — RF Troubleshooting

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General RF Troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Pre-baking

These parts are moisture sensitive and must be pre-baked prior to soldering:

- RFIC N7505
- Front End Module (FEM) N7520

Discrete components

In addition to the key-components, there are a number of discrete components (resistors, inductors and capacitors) for which troubleshooting is done mainly by *visual inspection*.

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

Note: In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

  Note: A mobile phone WCDMA transmitter should never be tested with full TX power (it is only possible to perform the measurements in a good RF-shielded room). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.

  Note: All communication Test Set Screen dumps are from CMU200. Other testers are different.

  Note: All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

The scope of this guideline is to enable repairs at key-component level. Some key-components are not accessible without replacing the whole shield frame (i.e. not replaceable). Please refer to the list of Non replaceable and replaceable RF components (page 4–7).

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RF key components

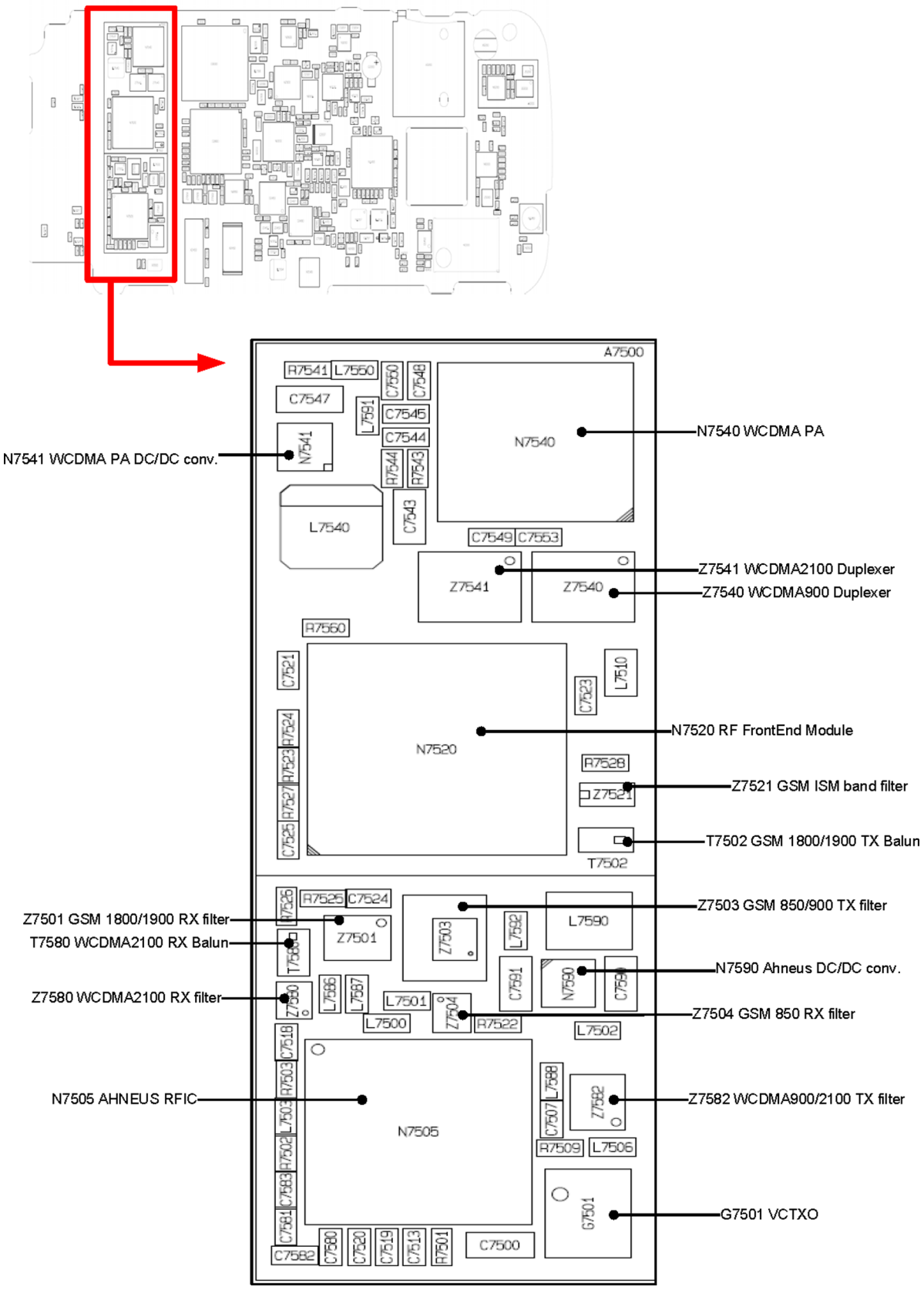

Figure 23 RF key components

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Non replaceable and replaceable RF components

Below are the lists of non-replaceable and replaceable RF components. If during replacement the shield is damaged, it should be replaced with a new one.

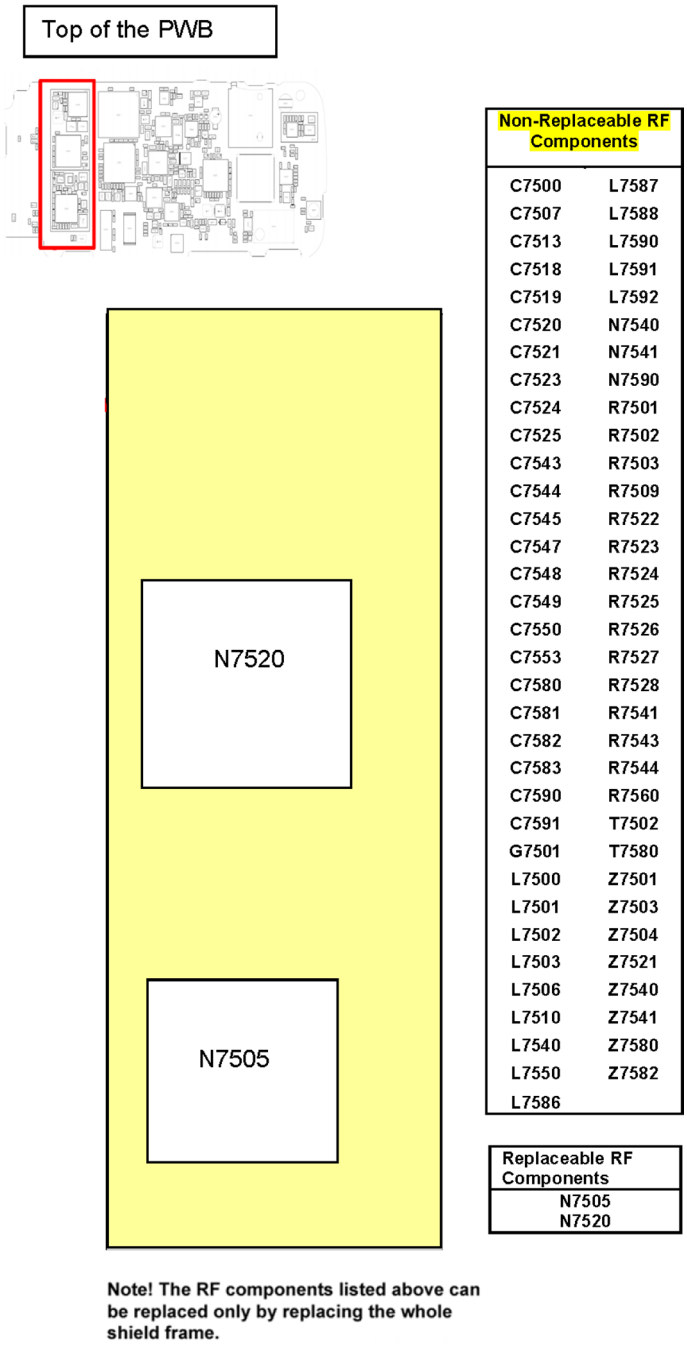

Figure 24 Non-replaceable and replaceable RF components

General voltage checking

Steps

1. Set up the main board in the module jig. The phone should be in local mode.
2. Check the following:

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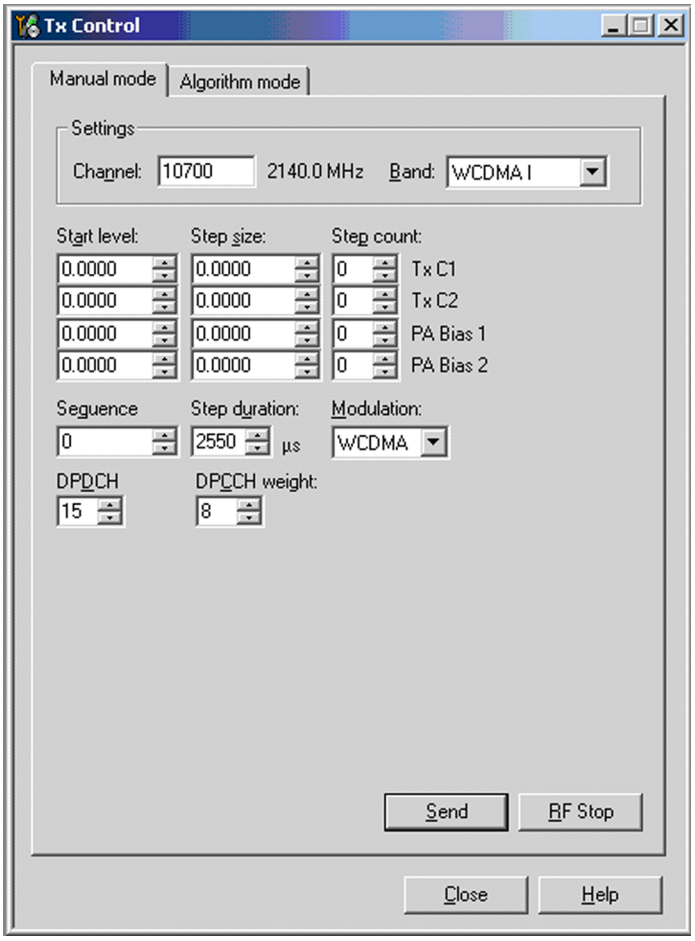
#	Signal name	Test point	Voltage (all bands)
1	VCTCXO supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	C7590	3.2 V
3	FEM supply	L7510	3.9 V
4	WCDMA PA supply from DC/DC conv	C7543	0 V (1.3 V* when transmitting. Settings as in figure below)
5	Vbat at WCDMA PA	C7547	3.9 V
6	Supply input to DC/DC conv	L7592	3.9 V



* With these settings, the result should be 1.3 V.

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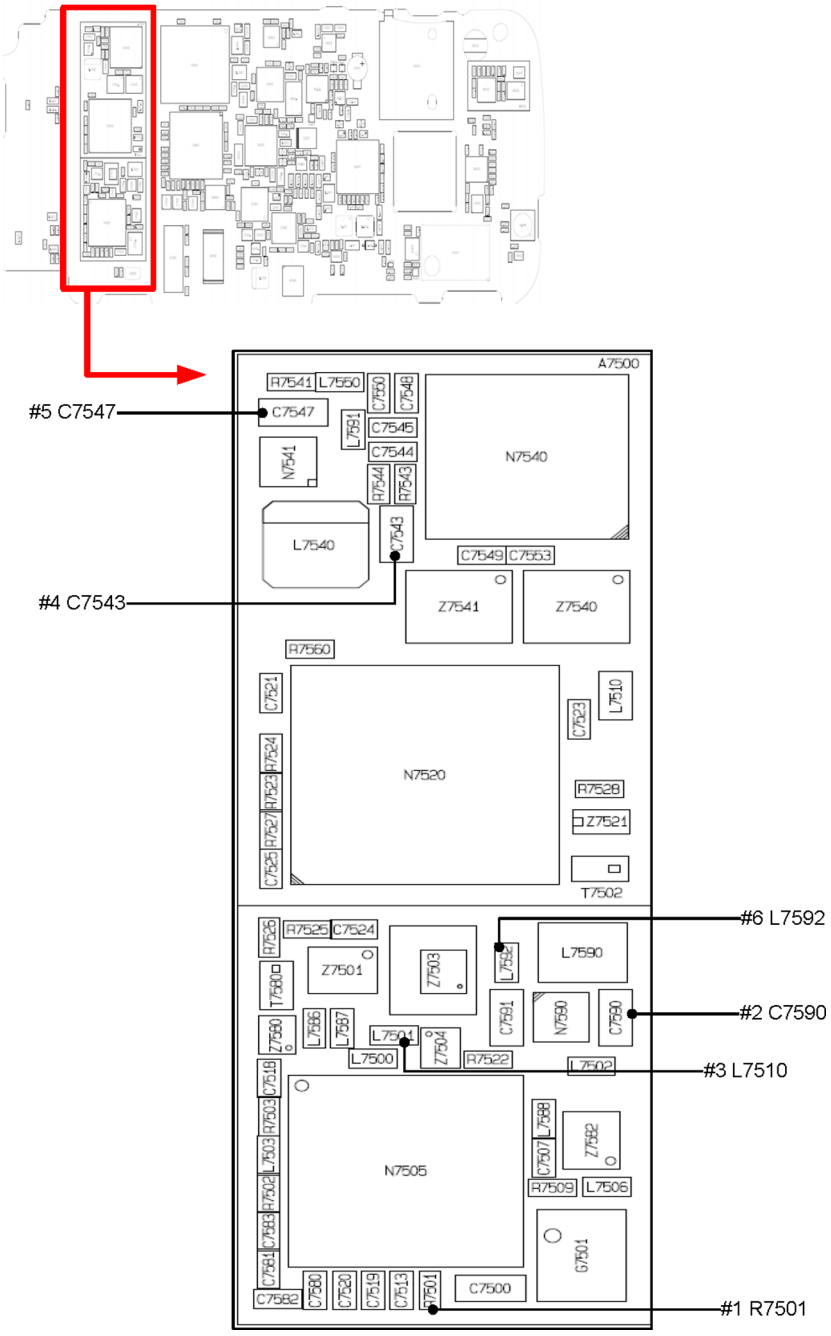

Figure 25 General voltage checking test points

Phoenix self tests

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.* in the baseband troubleshooting section.

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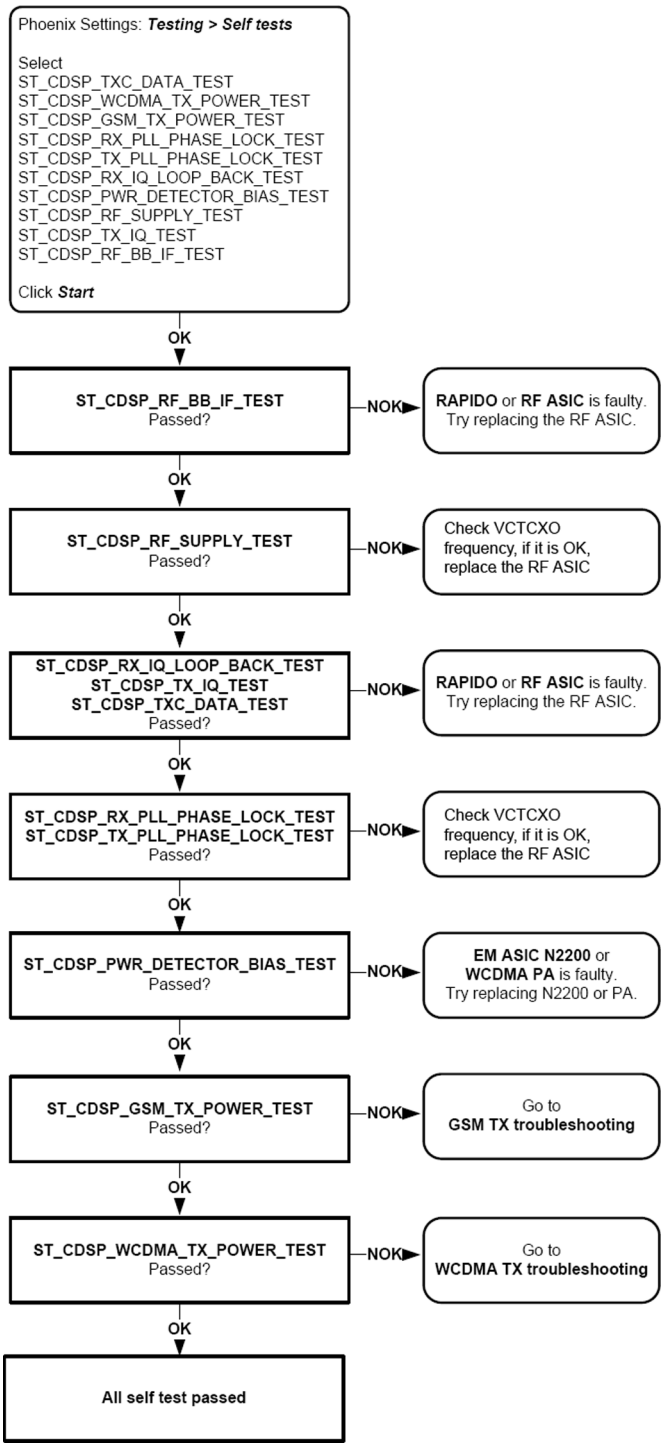
Troubleshooting flow



Receiver Troubleshooting

Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

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The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see GSM RX chain activation for manual measurements / GSM RSSI measurement (page 4–11). For a similar test in WCDMA mode, see WCDMA RSSI measurement (page 4–13).

GSM RX chain activation for manual measurements/GSM RSSI measurement

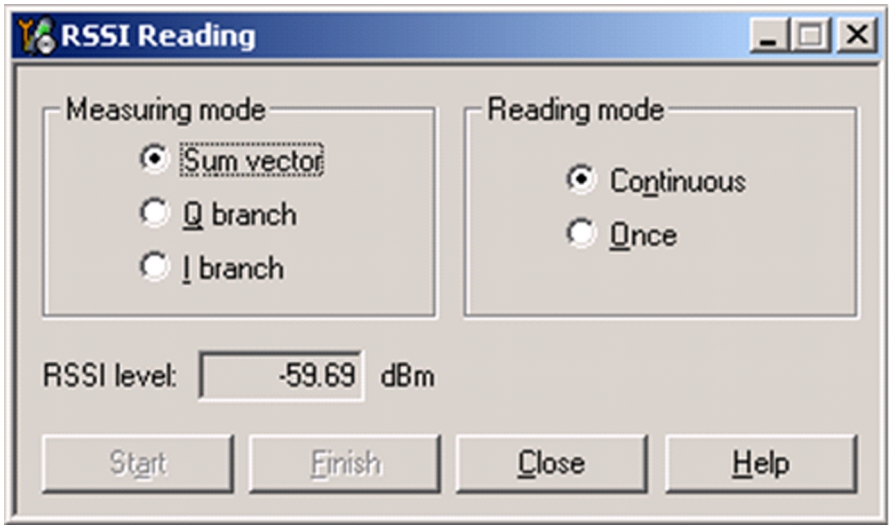
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771MHz (67.71kHz offset) at -60dBm	942.46771MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.06771MHz (67.71kHz offset) at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)



Results

The reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

WCDMA RX chain activation for manual measurement

Prerequisites

Make the following settings in Phoenix service software:

Setting	WCDMA2100	WCDMA900
Phoenix Channel	10700	3012

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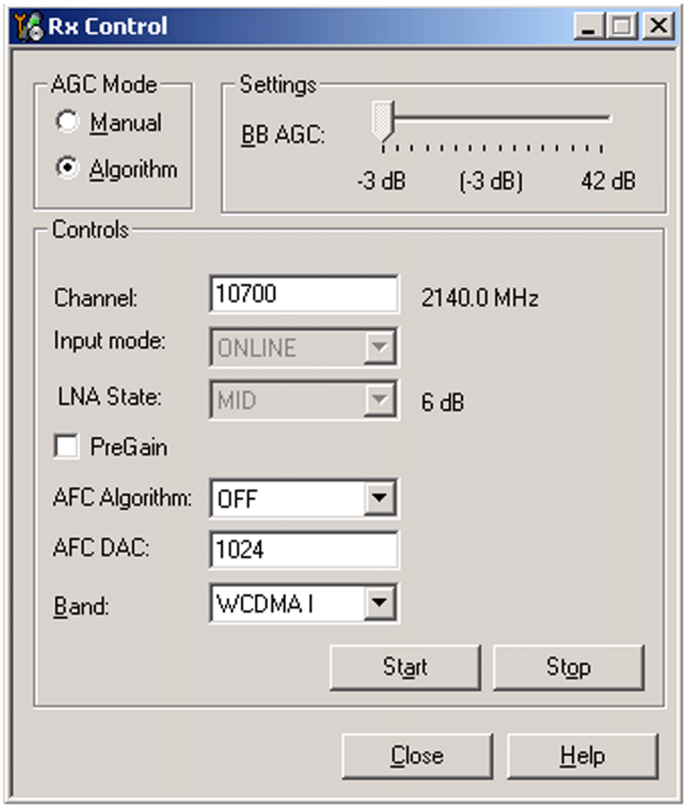
Setting	WCDMA2100	WCDMA900
Signal generator to antenna connector	2140 MHz	942,4 MHz
Band	I	VIII

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:



3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.

4. Set the following RF generator settings:

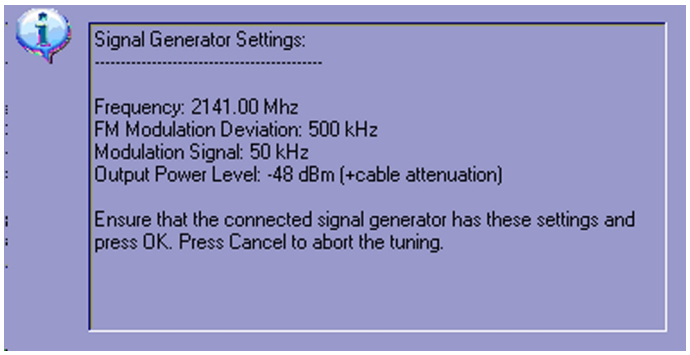


Figure 26 WCDMA RX generator settings

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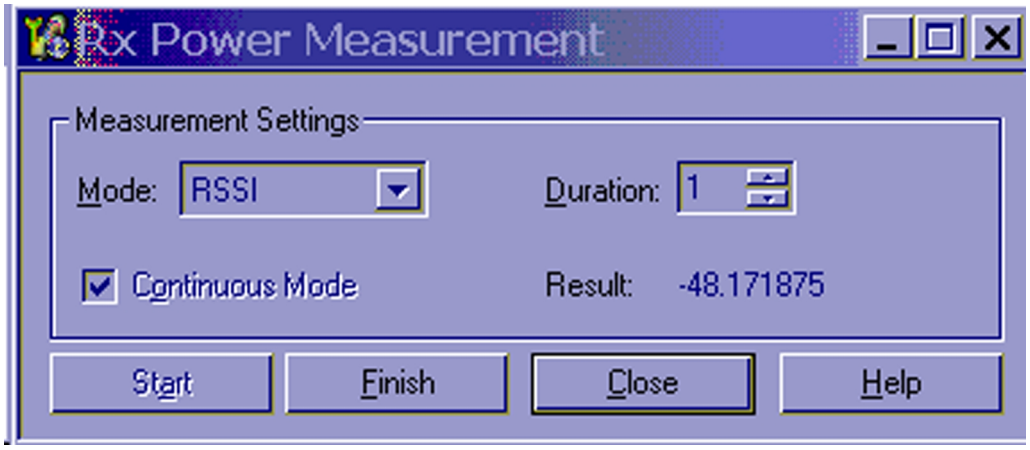
WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to WCDMA RX chain activation (page 4–11).

Steps

1. From the Phoenix testing menu, select **WCDMA→RX Power measurement**
2. In the RX Power measurement window, select:
   - Mode: RSSI
   - Continuous mode



3. Click **Start** to perform the measurement.

Transmitter Troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”; in WCDMA transmitter testing the best tool is “TX Control”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production

  Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM or WCDMA Power amplifier (PA) may be damaged.

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).

   Use the following settings:

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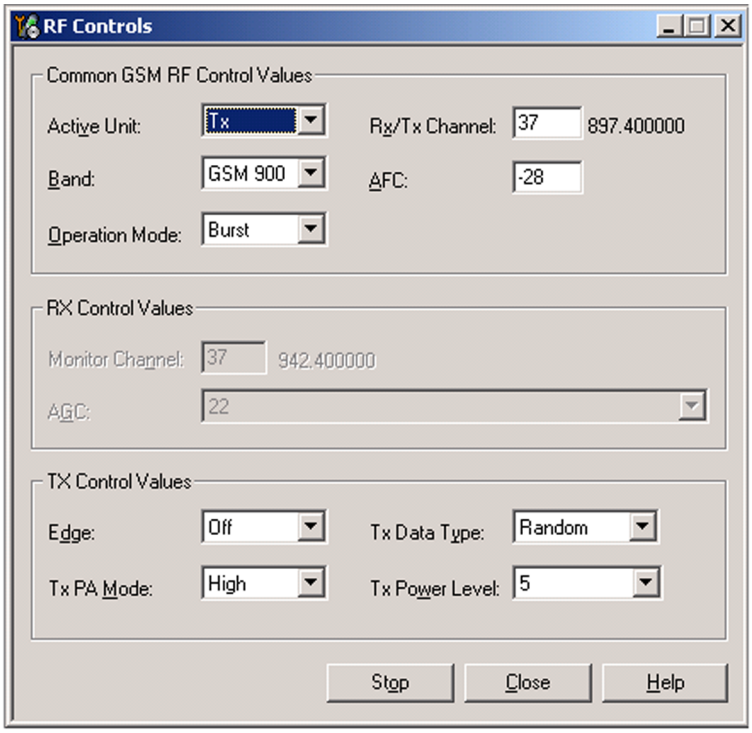

3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

   Note: Never set Operation Mode to continuous for any length of time.

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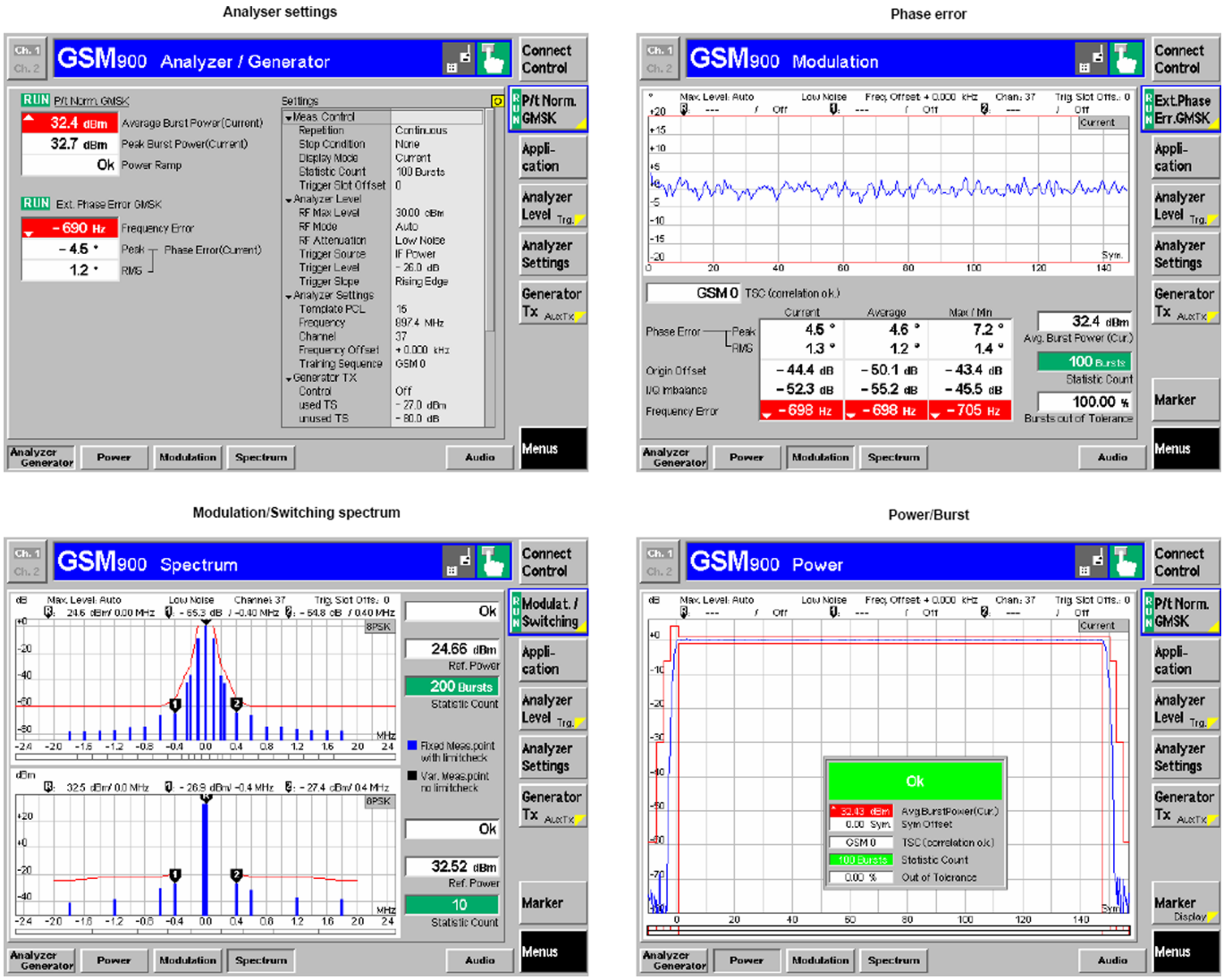

Figure 27 Typical readings

4. Change the power level (RF controls) and make sure the power reading follows accordingly.

Next actions

You can troubleshoot the GSM transmitter for each GSM band separately, one band at a time. If you want to troubleshoot GSM850, GSM1800 or GSM1900, change the band with the RF controls and set the communication analyser accordingly.

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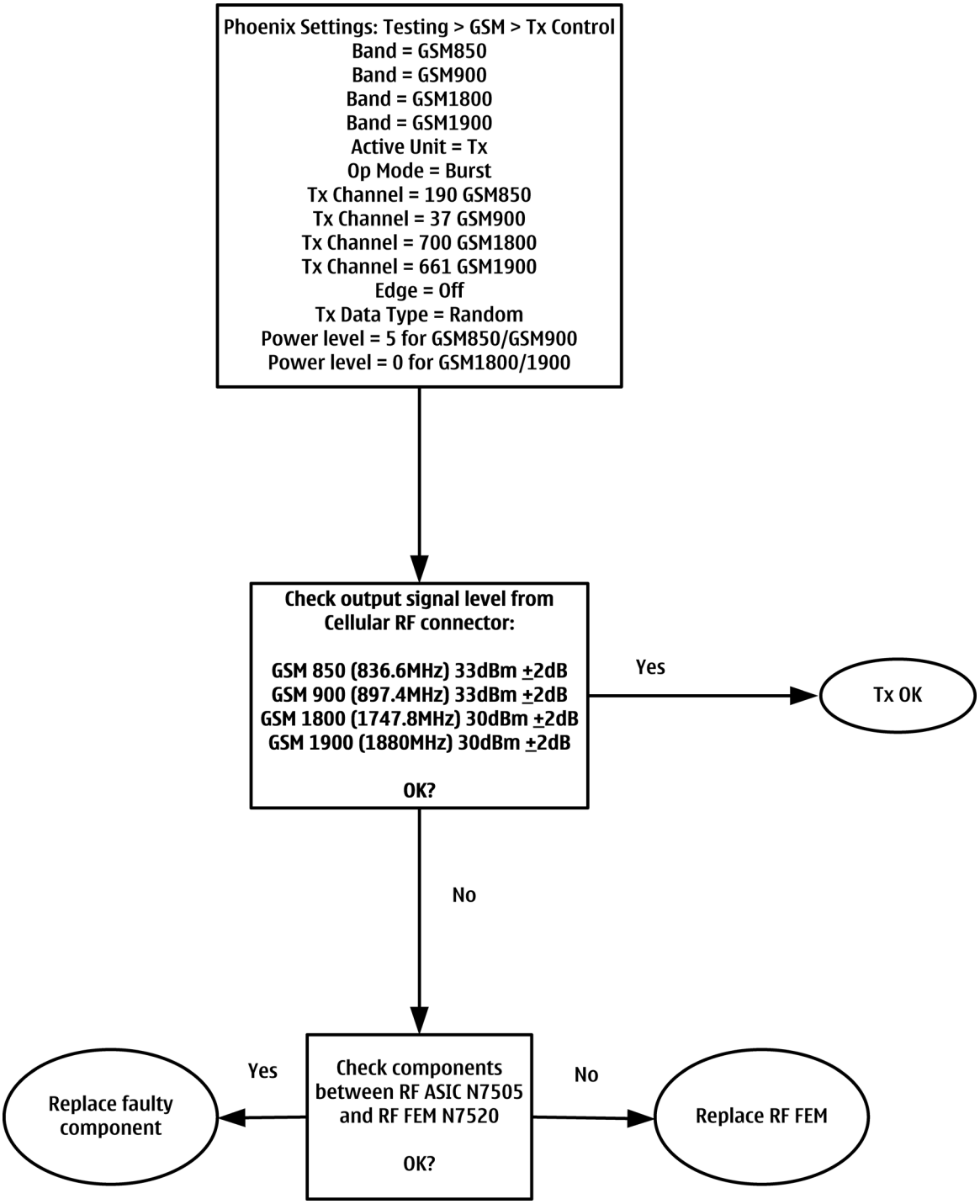
GSM transmitter troubleshooting flowchart

Troubleshooting flow



WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing→WCDMA→TX control** .

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3. Use the following settings in the TX control window:

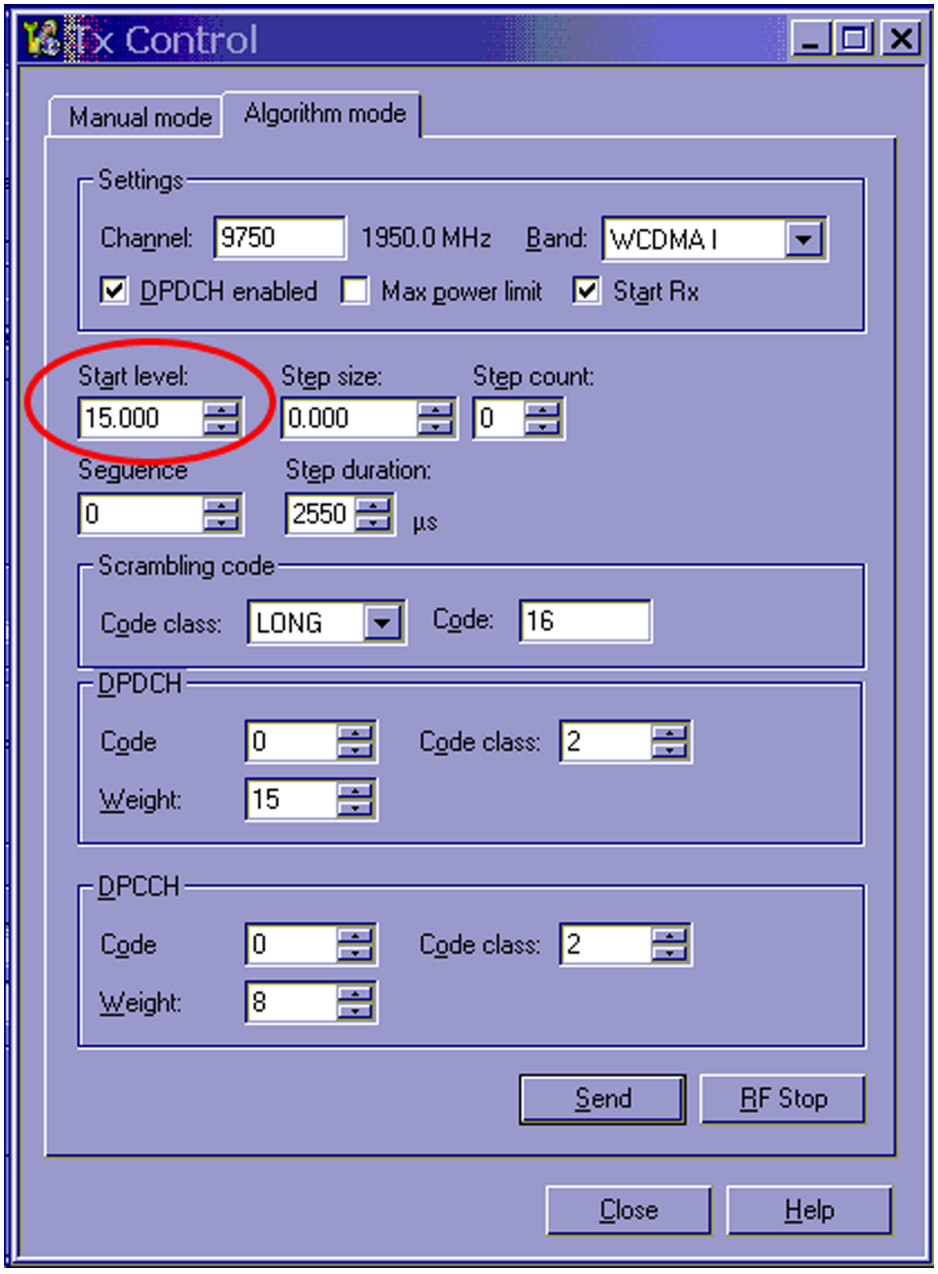

Figure 28 Phoenix WCDMA TX control window

Note: Use the **Start level** option to set the TX power level.

4. Click **Send** to enable the settings and activate TX.
   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.
5. Use the CMU200 to check the WCDMA power.

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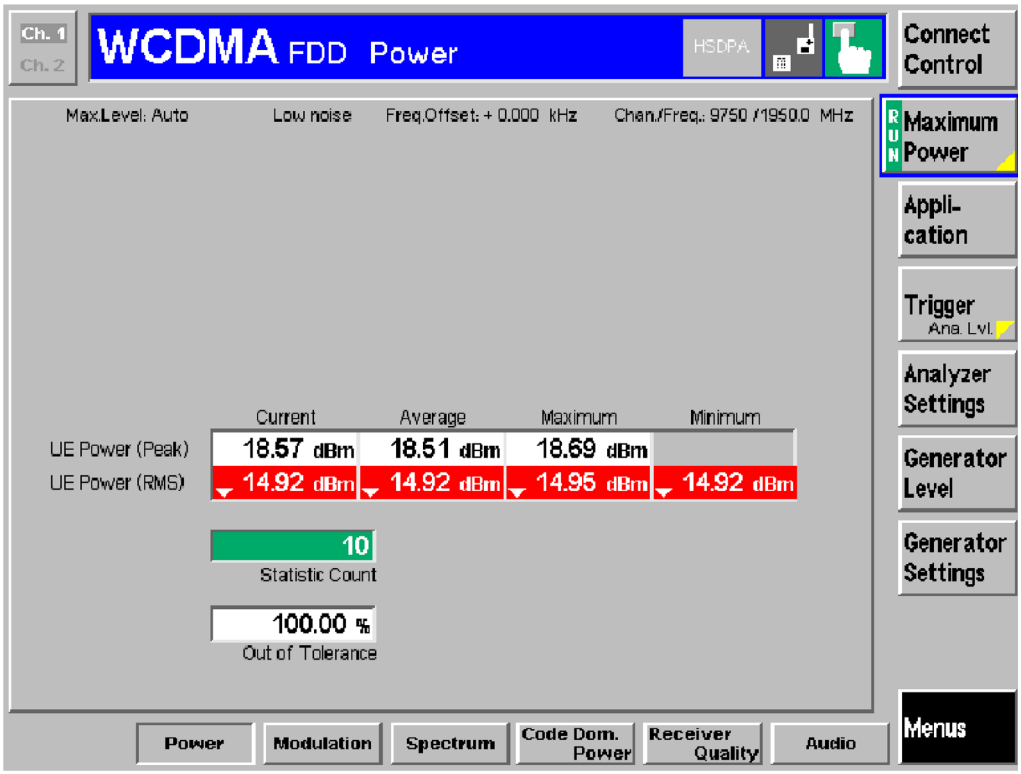
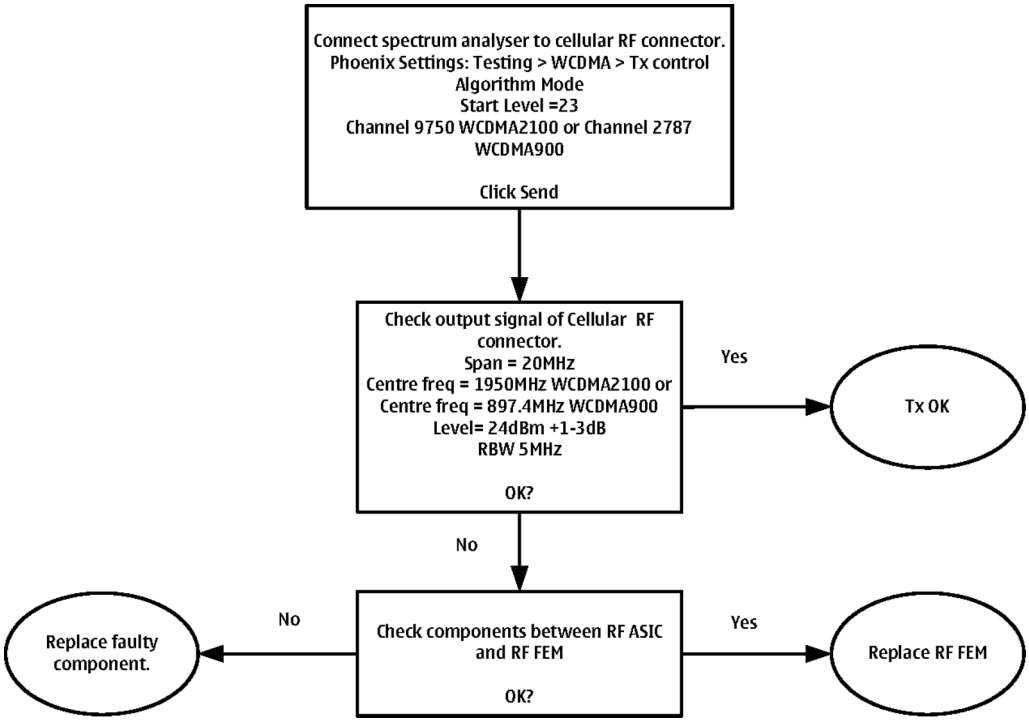


Figure 29 WCDMA power window

WCDMA transmitter troubleshooting flowchart

Troubleshooting flow



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RF Tunings

Introduction to RF tunings

Important: Only perform RF tunings if:

- one or more of the RF components have been replaced
- flash memory chip is replaced or corrupted.

RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF part.

Important: After RF component replacements, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup.

Autotuning for BB5

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRS-6 (RF cable that requires an additional product-specific adapter cable), USB cable, GPIB cable and DAU-9S
- 6dB attenuator (suitable to cover tuning frequency range) between CMU200 and Module jig (location is close to the module jig). Ensure that the 6dB pad loss is added in the Jig losses.
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

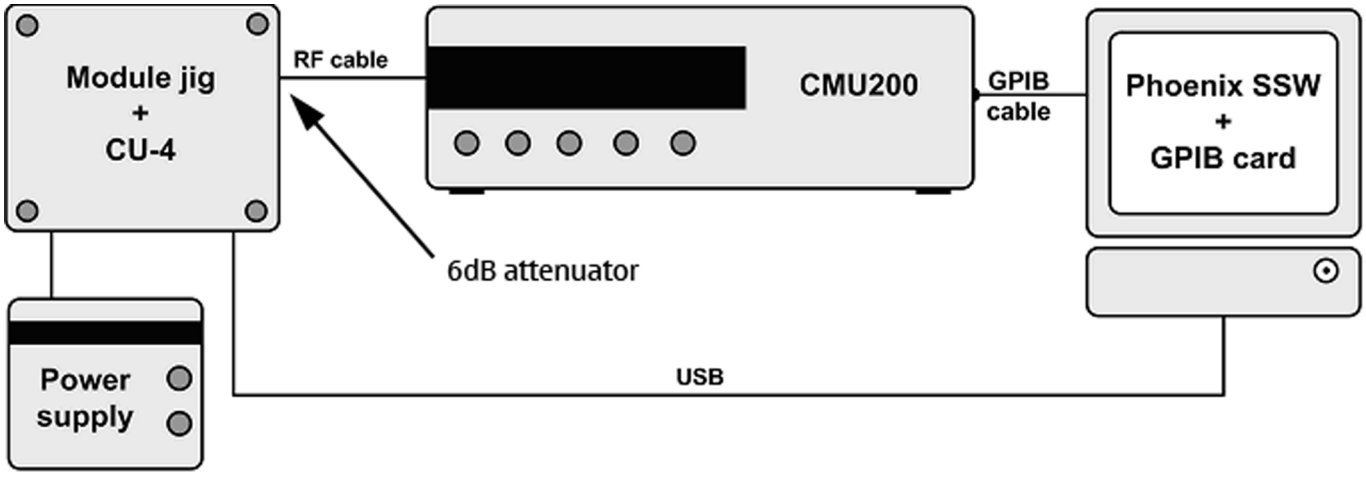

Figure 30 Auto tuning concept with CMU200

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Phoenix preparations

Install the phone-specific data package. This defines the phone-specific settings.

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.
2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.
3 Remember to set the correct attenuation values before autotuning.
4 To start autotuning, click the *Tune* button.

System Mode Independent Manual Tunings

RF channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of the RF ASIC, that limit the bandwidth of BB IQ signals.

Table 10 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
RX mixer	0	13	31
Rx filter	0	16	31

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results

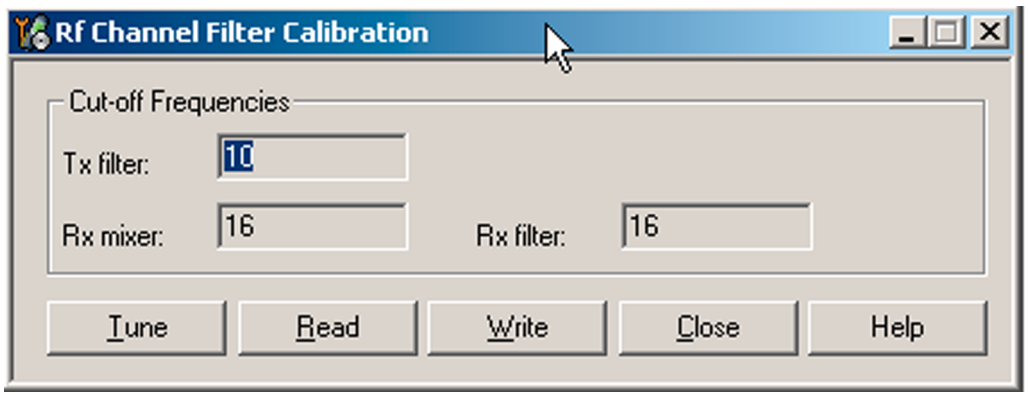

Figure 31 Rf channel filter calibration typical values

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PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

GSM Receiver Tunings

Rx calibration (GSM)

Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Rx Calibration** .

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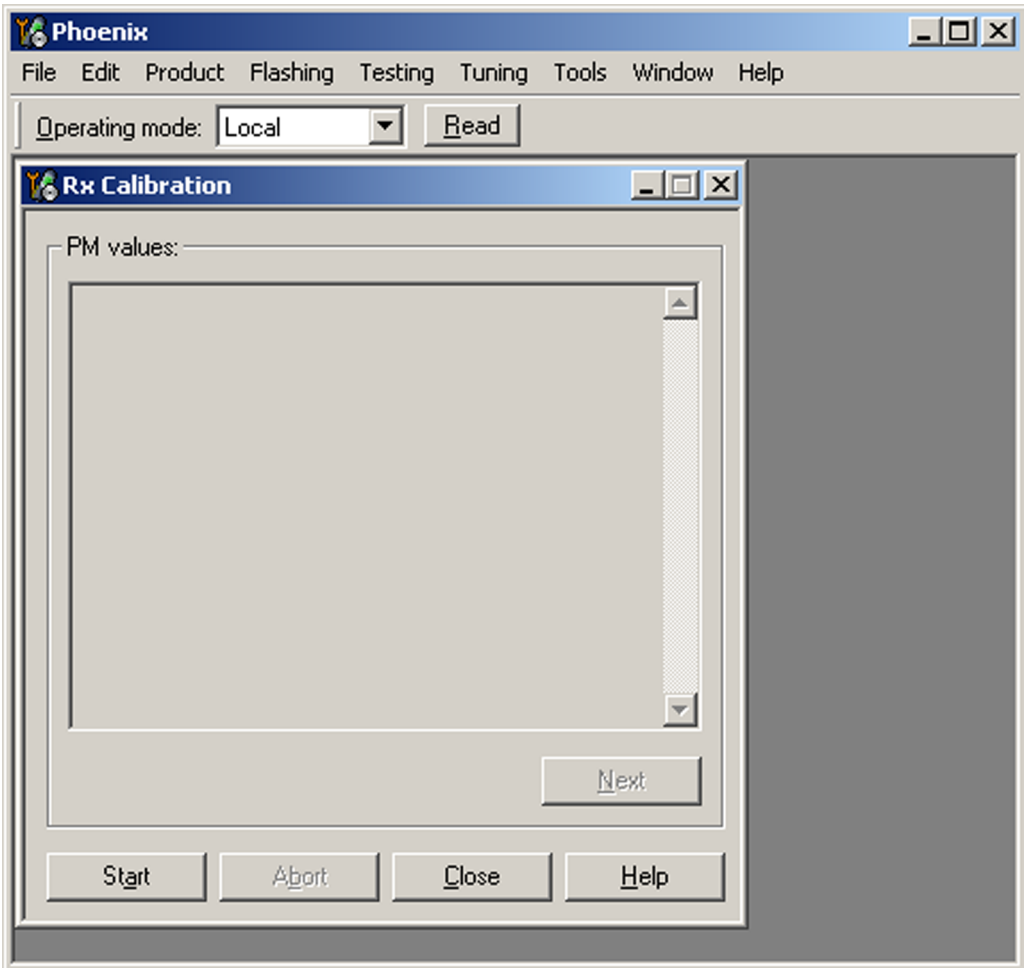
5. Click **Start**.



6. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** (step 1-3) pop-up window.

   Important: The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.

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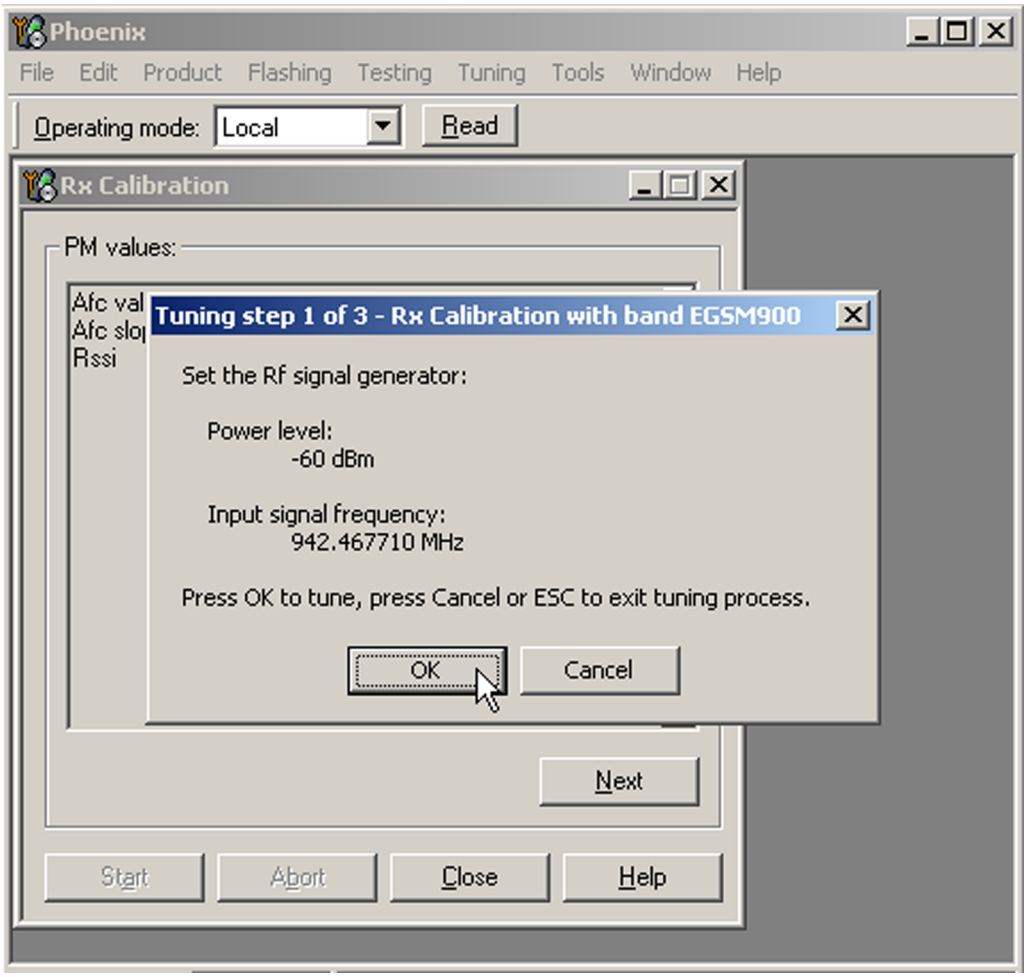

7. To perform the tuning, click **OK**.
8. Check that the tuning values are within the limits specified in the following table:

Table 11 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
AFC Value (init)	-200	-80..40	200	dB
AFC slope	0	108..121	200	dB
RSSI (AGC-0)	106	107..110	114	dB
GSM900				
AFC Value (init)	-200	-105..62	200	dB
AFC slope	0	122	200	dB
RSSI (AGC-0)	106	107...110	114	dB
GSM1800				
RSSI (AGC-0)	105	105...109	114	dB
GSM1900				
RSSI (AGC-0)	105	105...109	114	dB

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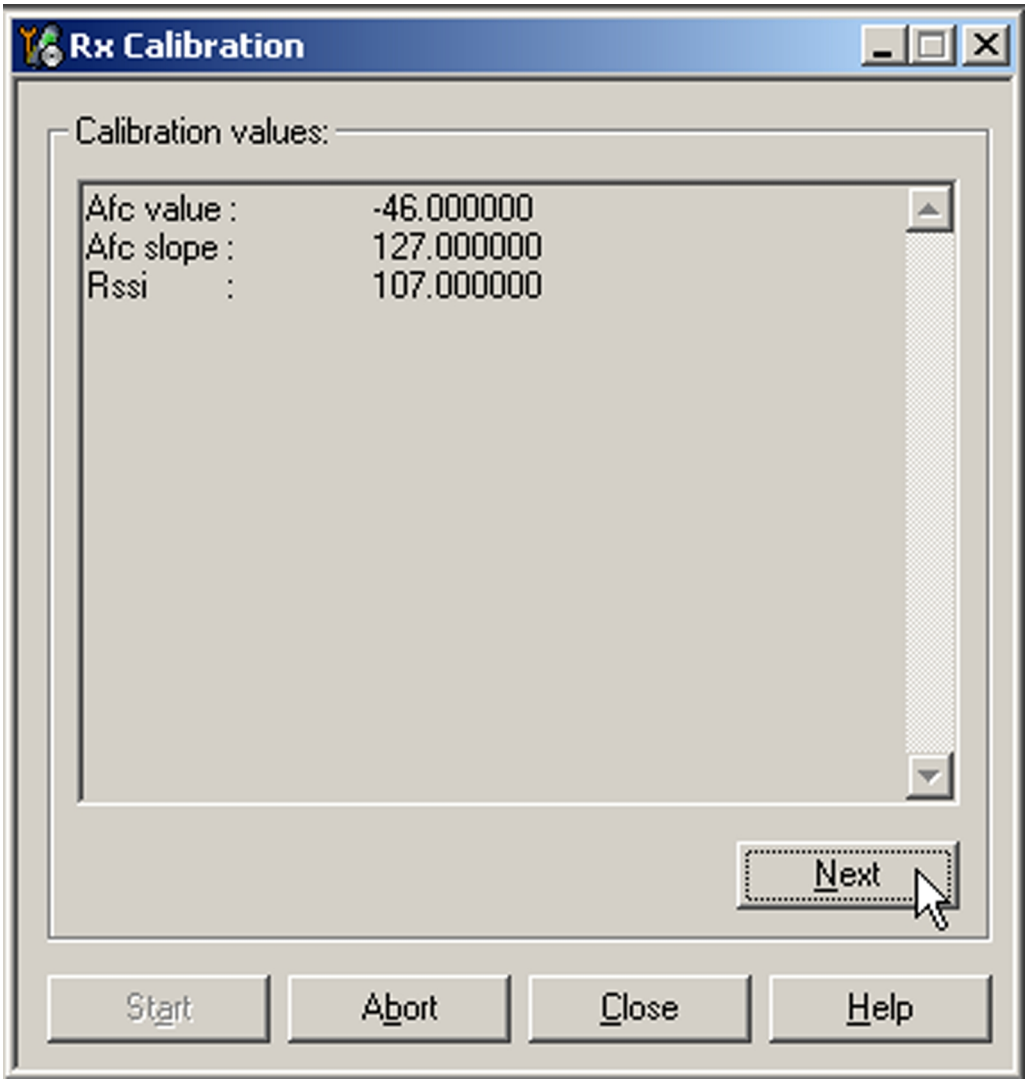
9. Click **Next** to continue with GSM1800 Rx tuning.



Next actions

Repeat steps 6 to 9for GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Prerequisites

Rx calibration must be performed before the Rx band filter response compensation.

Context

On each GSM Rx band, there is a band filter in front of the RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement, and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.

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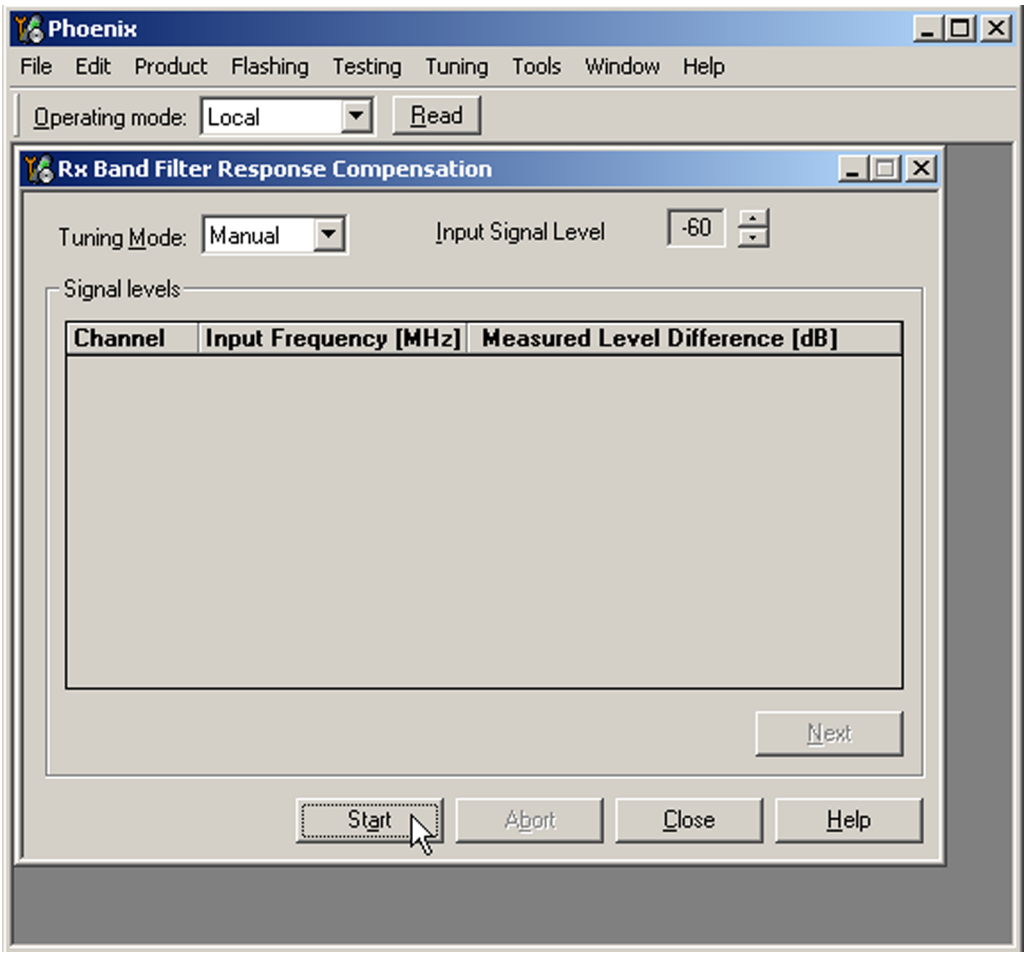
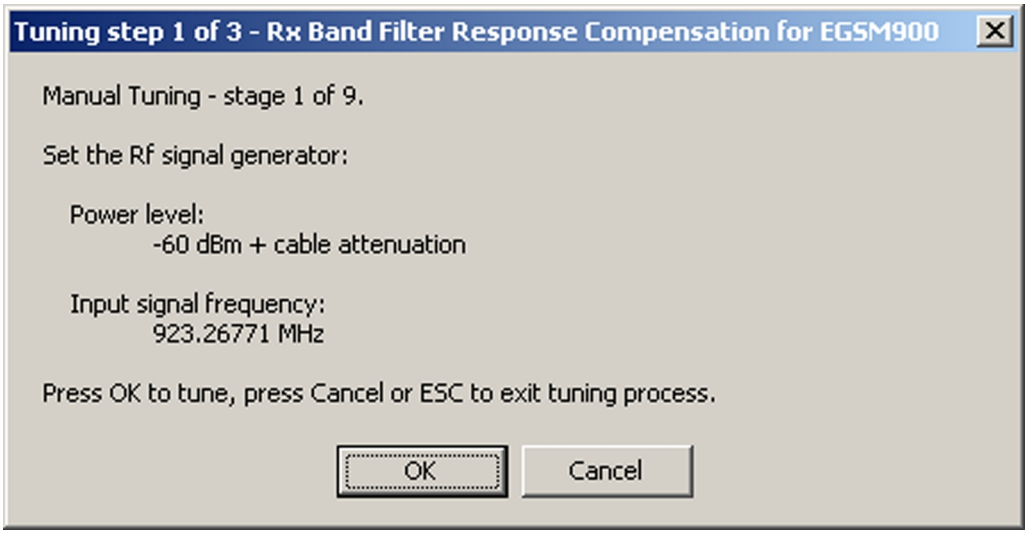
4. Select **GSM900** band.
5. Choose **Tuning→GSM→Rx Band Filter Response Compensation** .
6. Select **Tuning mode: manual**
7. Click **Start**.



8. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the *Rx Band Filter Response Compensation for EGSM900* pop-up window, step 1-3.



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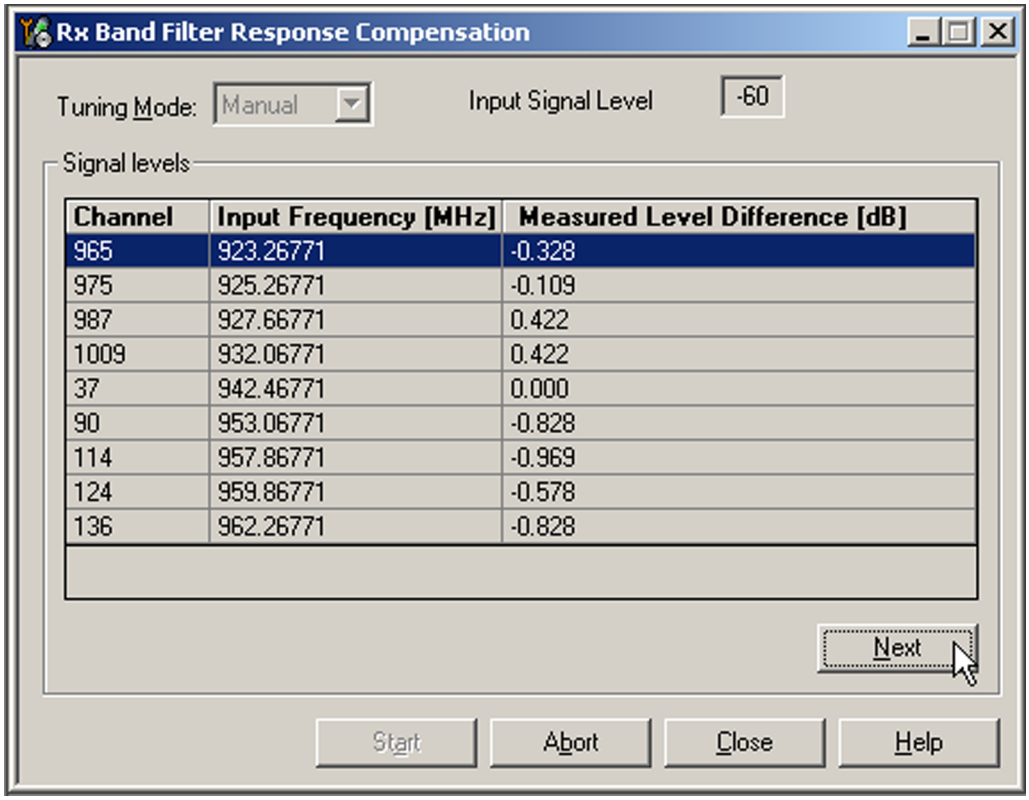
9. To perform tuning, click **OK**.
10. Go through all 9 frequencies. The following table will be shown:



11. Check that the tuning values are within the limits specified in the following table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118/867.26771 MHz	-6	-1	2	dB
Ch. 128/869.26771 MHz	-3	0	2	dB
Ch. 140/871.66771 MHz	-3	0	2	dB
Ch. 172/878.06771 MHz	-2	0	2	dB
Ch. 190/881.66771 MHz	-2	0	2	dB
Ch. 217 / 887.06771 MHz	-2	0	2	dB
Ch. 241/891.86771 MHz	-3	0	2	dB
Ch. 251/893.86771 MHz	-3	0	2	dB
Ch. 261/895.86771 MHz	-6	-1	-2	dB
GSM900				
Ch. 965 / 923.26771 MHz	-6	-1	2	dB
Ch. 975 / 925.26771 MHz	-3	0	2	dB
Ch. 987 / 927.66771 MHz	-3	0	2	dB
Ch. 1009 / 932.06771 MHz	-2	0	2	dB

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	Min	Typ	Max	Unit
Ch. 37 / 942.46771 MHz	-2	0	2	dB
Ch. 90 / 953.06771 MHz	-2	0	2	dB
Ch. 114 / 957.86771 MHz	-3	0	2	dB
Ch. 124 / 959.86771 MHz	-3	0	2	dB
Ch. 136 / 962.26771 MHz	-6	-1	2	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-6	-1	3	dB
Ch. 512 / 1805.26771 MHz	-3	0	3	dB
Ch. 535 / 1809.86771 MHz	-3	0	3	dB
Ch. 606 / 1824.06771 MHz	-3	0	3	dB
Ch. 700 / 1842.86771 MHz	-3	0	3	dB
Ch. 791 / 1861.06771 MHz	-3	0	3	dB
Ch. 870 / 1876.86771 MHz	-3	0	3	dB
Ch. 885 / 1879.86771 MHz	-3	0	3	dB
Ch. 908 / 1884.46771 MHz	-6	-1	3	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-6	-1	2	dB
Ch. 512 / 1930.26771 MHz	-3	0	2	dB
Ch. 537 / 1935.26771 MHz	-3	0	2	dB
Ch. 586 / 1945.06771 MHz	-3	0	2	dB
Ch. 661 / 1960.06771 MHz	-3	0	2	dB
Ch. 736 / 1975.06771 MHz	-3	0	2	dB
Ch. 794 / 1986.66771 MHz	-3	0	2	dB
Ch. 810 / 1989.86771 MHz	-3	0	2	dB
Ch. 835 / 1994.86771 MHz	-6	-1	2	dB

12. If the values are within the limits, click **Next** to continue to the next band.

Next actions

Repeat the steps 8 to 12 for GSM1800 and GSM1900.

GSM Transmitter Tunings

Tx IQ tuning (GSM)

Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.

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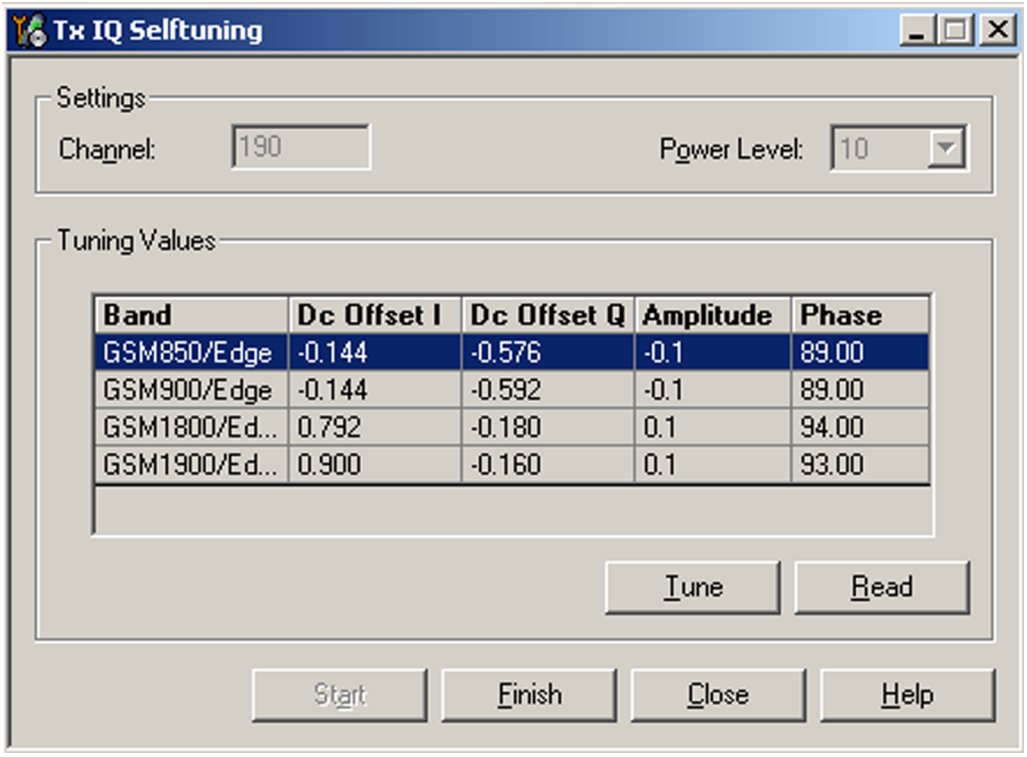
Tx IQ tuning must be performed for all GSM bands.

Steps

1. Start *Phoenix* service software.
2. From the **Operating mode** drop-down menu, set mode to **Local**.
3. Choose **Tuning→GSM→Tx IQ Tuning** .
4. Select **Mode: Automatic**.



5. Select **Band: GSM900** and click **Start**.
6. Click **Next** to start GSM1800 band TX IQ tuning.
7. Click **Next** to start GSM1900 band TX IQ tuning.
8. Click**Finish** and then **Close**.

Next actions

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the following table. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM900				

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	Min	Typ	Max	Unit
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	°

Tx power level tuning (GSM)

Context

Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

For EDGE transmission, the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a spectrum analyzer.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Tx Power Level Tuning** .

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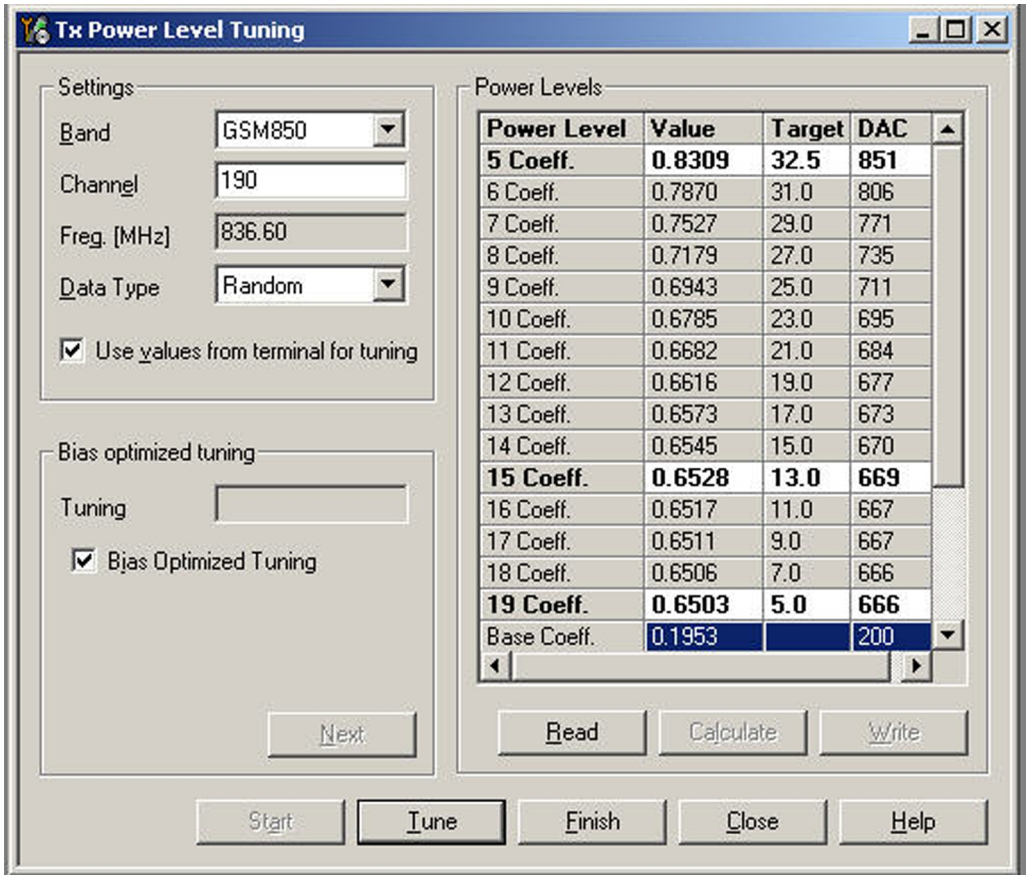
5. Click **Start**.l



6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: • **836.6 MHz GSM850** • **897.4MHz GSM900** • **1747.8MHz GSM1800** • **1880MHz GSM1900**
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)
Resolution BW	3MHz
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations into account.

7. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

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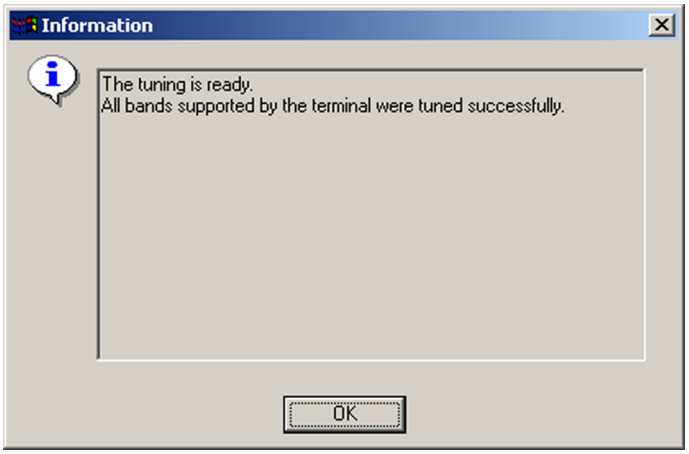
8. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.
9. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:



WCDMA Receiver Tunings

RX calibration (WCDMA)

Context

Rx calibration tuning routine calculates the real gain values of the WCDMA Rx AGC system. There is also a SAW filter between front end LNA and mixer in the receive chain, which causes ripple in the RSSI measurement, this is calibrated out. The SAW filter is intergated into RF ASIC N7500.

Rx calibration can be done in two different ways, manual tune and sweep mode tune. If the signal generator in use supports frequency sweep table, the calibration is done in one step.

Steps

1. For manual tuning, set mode to **Local** in the **Operating Mode** dropdown menu.
2. In the **Tuning** menu, choose **WCDMA→Rx Calibration** .
3. Click **Start**.
4. Select Band "WCDMA2100 or WCDMA900".
5. Click **Tune**.

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6. Setup the signal generator to correspond with the values on the, *Rx Calibration* pop-up window and click **OK**.

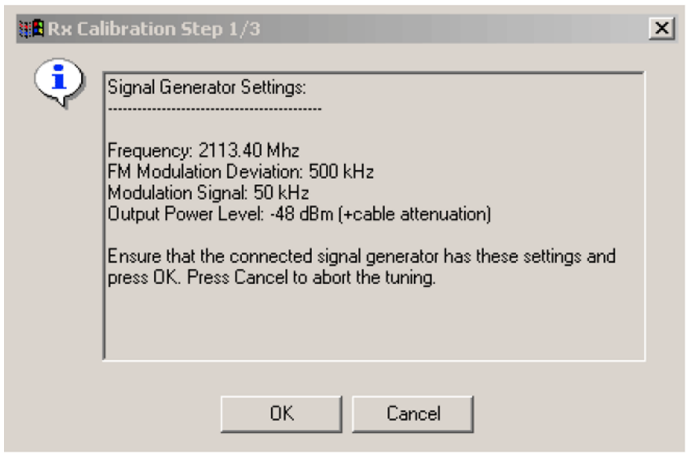
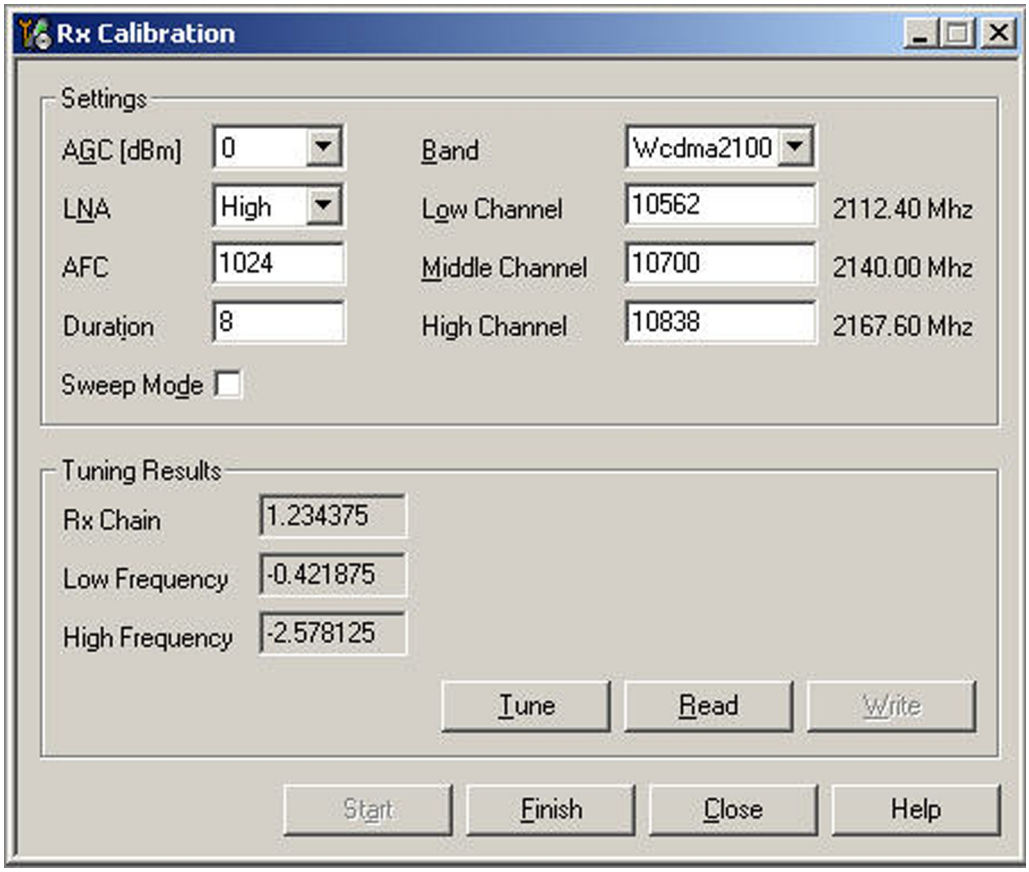


Figure 32 Pop-up window for WCDMA2100

7. Repeat step 6. for Middle and High channels.



8. Ensure Tuning Results are within limits specified in the table below:
   If values are OK, click **Write** to save the values.

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	Band	Min	Typ	Max	Unit
Rx chain	2100 or 900	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	

Alternative steps

- For sweep mode tuning, set **Mode** to **Local** in the **Operating Mode** dropdown menu.
- In the **Tuning** menu, choose **WCDMA→ Rx Calibration** .
- Click **Start**.
- Select **Band**, "WCDMA2100 or WCDMA900".
- Check the **Sweep Mode** box.
- Click **Tune**.
- Setup the signal generator to correspond with the values on the *Rx Calibration* pop-up window and click **OK**.

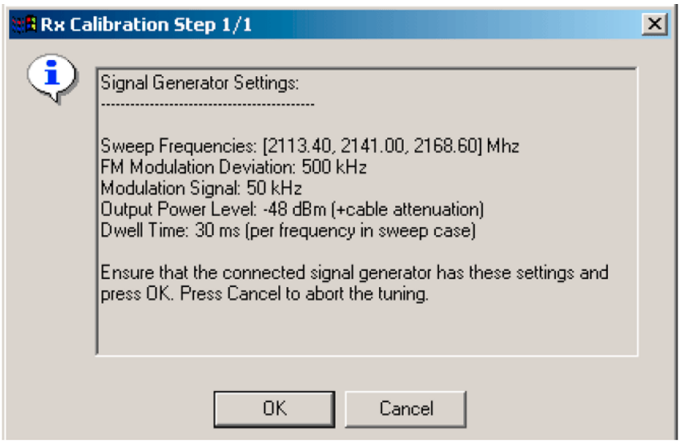

Figure 33 Pop-up window for WCDMA2100

- Ensure Tuning Results are within limits specified in the table above: If values are OK, click **Write** to save the values to the phone.
- Close the tuning window.

WCDMA Transmitter Tunings

Tx AGC & power detector (WCDMA)

Context

Tx AGC & power detector tuning has two purposes:

- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

There are two ways to perform the tuning. For an alternative method, see Alternative steps (page 4–39).

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.

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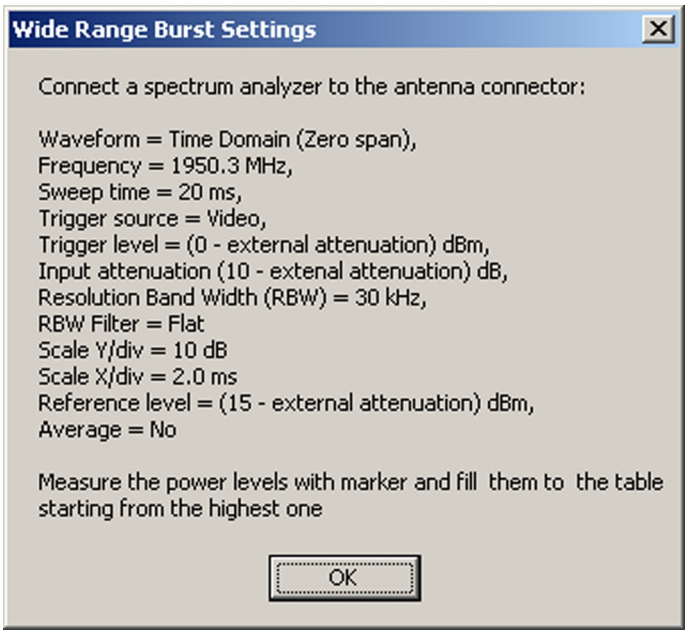
2. Choose **Tuning→WCDMA→Tx AGC & Power Detector.**
3. Click **Start**.
4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).
5. Set up the spectrum analyzer in the following way:



6. After setting the spectrum analyzer, click **OK**.
7. Measure the power levels with a marker.

   Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1250 us and so on for every 500 us until the table is filled.

   Note: It must be possible to measure power levels down to –68 dBm. The measured power levels must be monotonously decreasing.

   Make sure that the marker is not measuring the level of noise spikes on lower levels.

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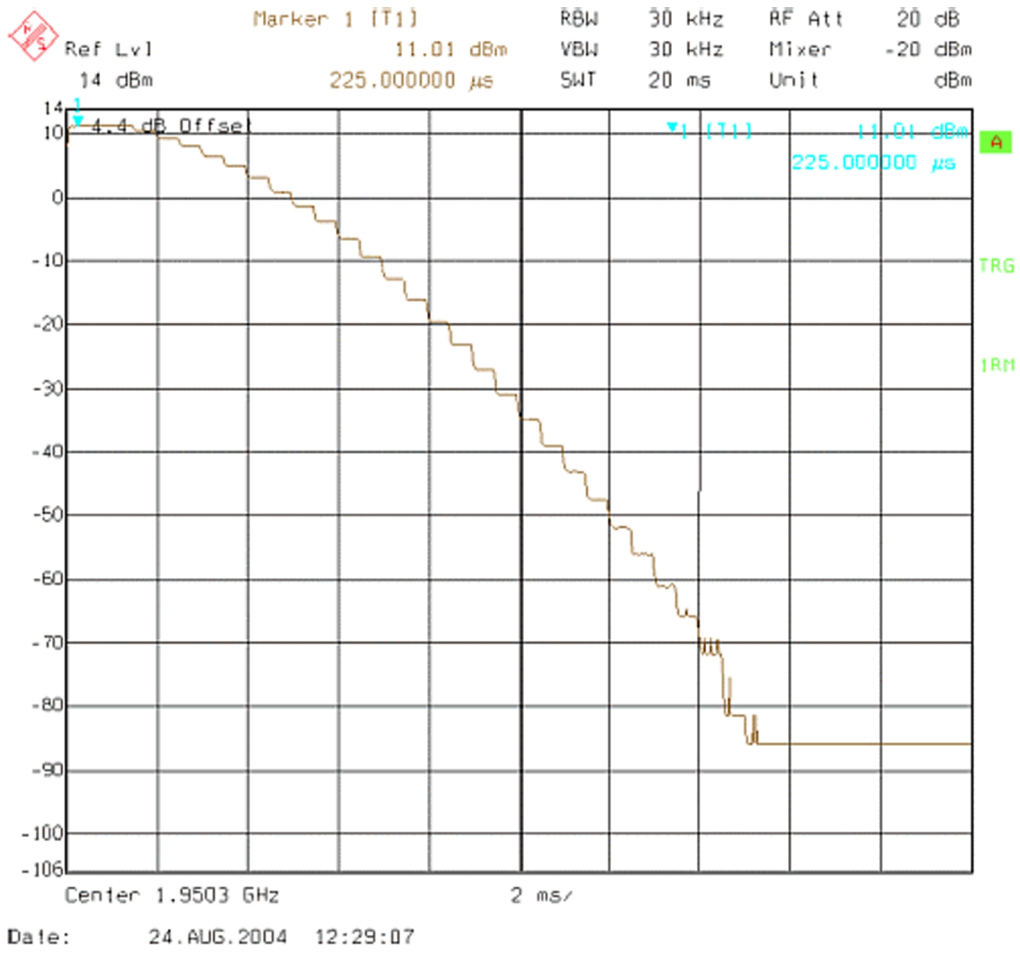

Figure 34 WCDMA power level tuning steps

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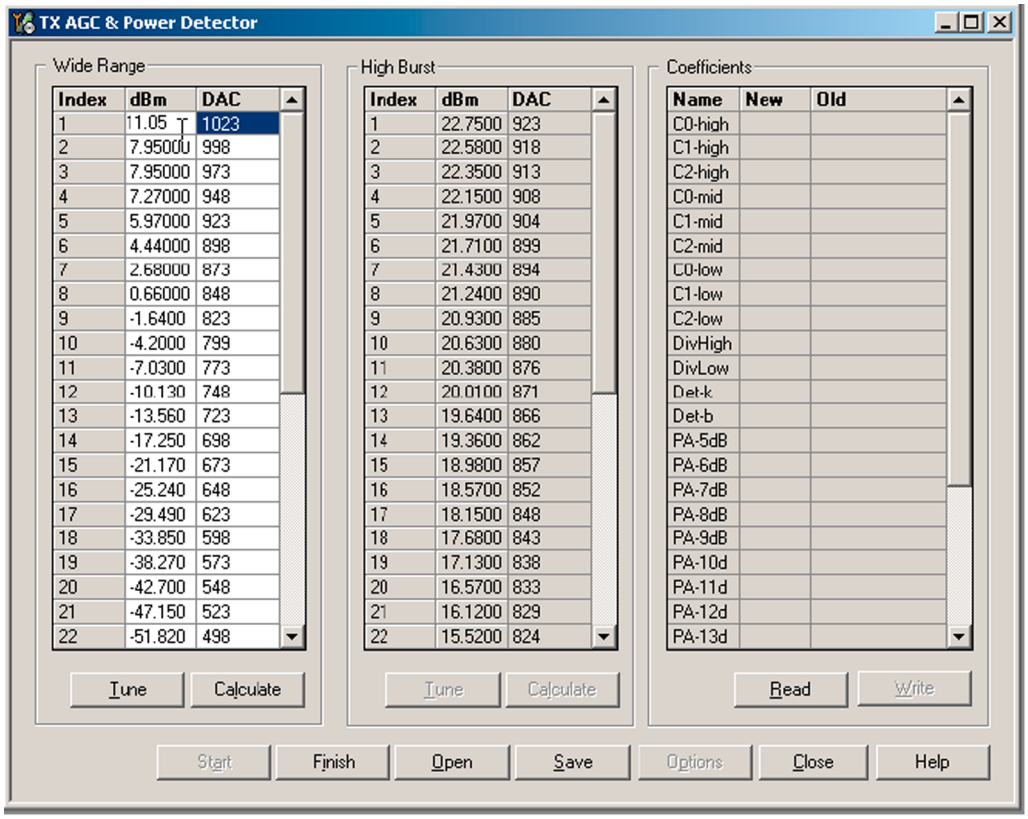
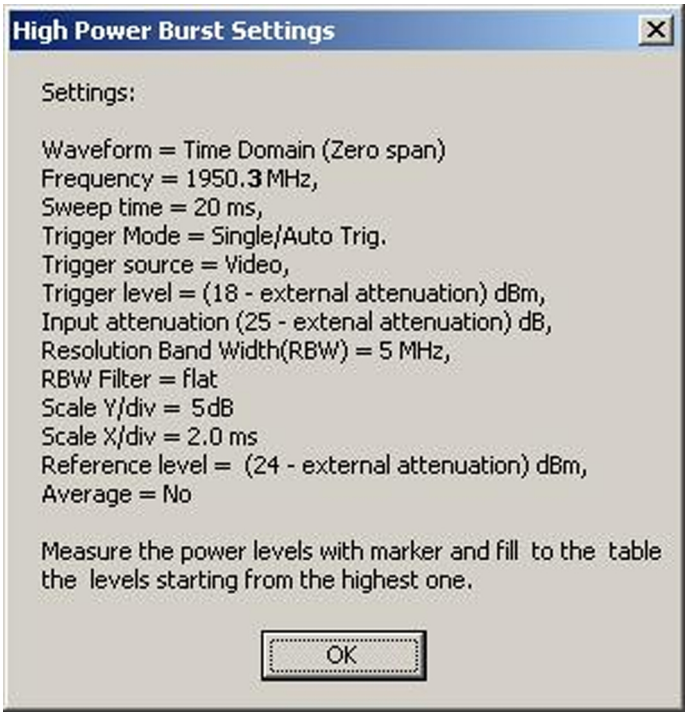
8. Fill in the power level values (in dBm) to the *Wide Range* table.



9. In the *Wide Range* pane, click **Calculate**.
10. In the *High Burst* pane, click **Tune**.
11. Adjust the spectrum analyzer according to the following settings:



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12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.

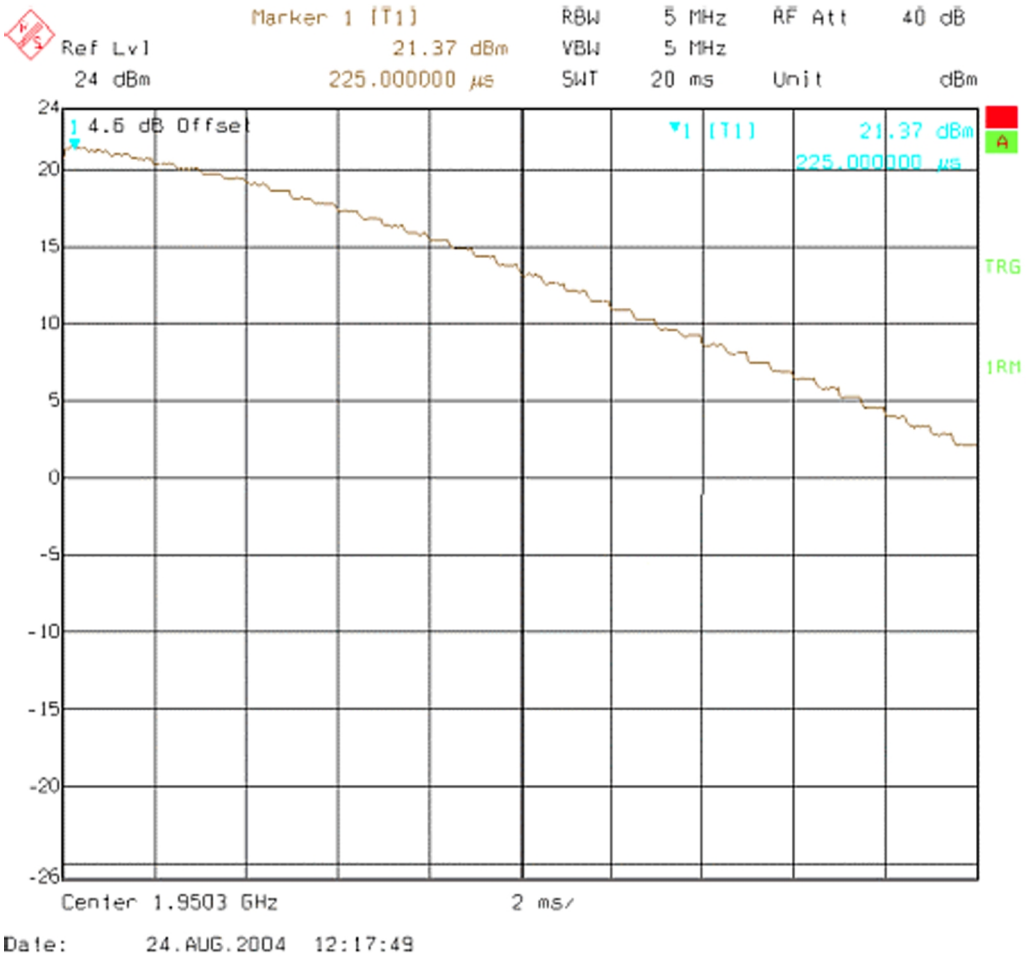

Figure 35 High burst measurement

13. In the *High Burst* pane, click **Calculate**.
14. Check that the calculated values are within the limits specified in the following table:

	Min	Max
C0-high	-0.5	5
C1-high	-50	50
C2-high	400	900
C0-mid	-0.7	0.7
C1-mid	0	50
C2-mid	400	900
C0-low	-4	4
C1-low	-400	440
C2-low	-10000	15000

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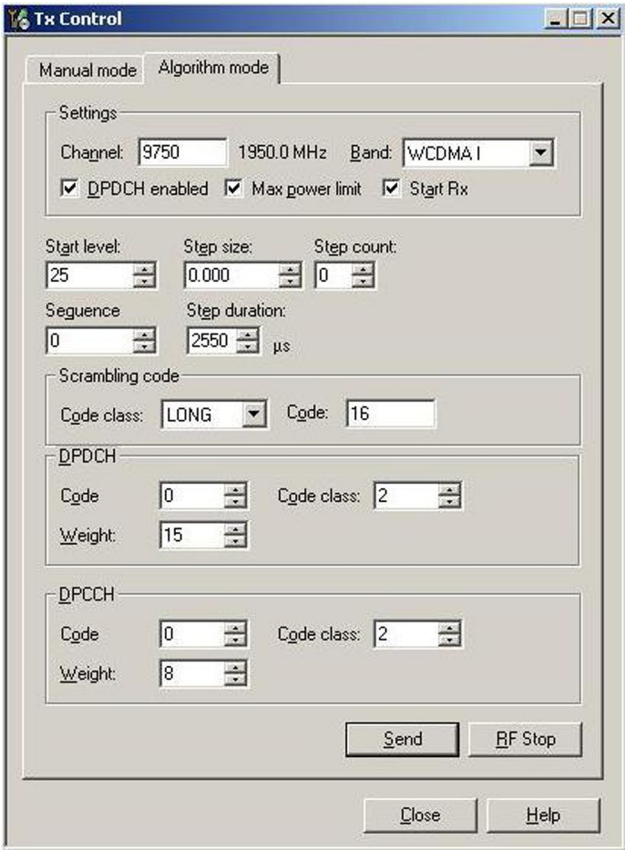
	Min	Max
Det-k	100	220
Det-b	0	150

15. To save the coefficients to the phone, click **Write**.
16. To close the *Tx AGC & Power Detector* window, click **Close**.
17. Choose **Testing→WCDMA→ Tx Control.**
18. Select the *Algorithm* mode tab.



19. Write the target power level 25 dBm to the *Start level* line and check the **Max power limit** check box (detector calibration check).
20. Setup the spectrum analyzer with the following settings:

Center frequency:	**1950MHz (WCDMA I)** or **897.4MHz (WCDMA VIII)**
Span:	0 Hz
Reference level offset:	Cable attenuations + adapter attenuation
Reference level:	**24 dBm or -20 dBm depending on the level measured**
Input attenuation:	Automatic
Resolution bandwidth:	5 MHz
Video bandwidth:	5 MHz
Sweep time:	20 ms

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Detector:	**RMS detector**
Average:	No
Trigger:	Free run

21. Click **Send**.
22. Measure the WCDMA output power.

    It should be around 23 dBm.
23. Click **RF Stop** and uncheck the **Max power limit** check box.
24. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

    The measured output power may not differ more than +-2 dB from the requested value at level +19 dBm and no more than +-4 dB on lower levels.

    Remember to stop the RF before sending new data.

Alternative steps

- Measure the wide range levels normally and write down the levels that are possible to measure.
- Click **Finish**.
- Click **Options**.
- Change the first wide range DAC value to 573 and change the number of tuning steps to 21.
- Change the spectrum analyzer reference level to –20 dBm and adjust the input attenuator to the lowest value possible.
- In the *Wide Range* pane, click **Tune** and fill in the rest of values starting from the 19th level.

Tx band response calibration (WCDMA)

Context

The purpose of this tuning operation is to calibrate the WCDMA Tx performance. It defines the power detector and Tx frequency compensation values. However, before starting this tuning procedure, it is necessary to carry out Tx AGC & Power Detector Calibration tuning. This is because its results will be needed for this tuning operation.

- In the *Tuning Settings* pane, it is possible to edit the numbers of channels used in this tuning operation.
- If the **Calibrate Detector Response** check box is checked, only Tx response is calibrated. Zero is written to the power detector compensation values block in the permanent memory (PM) of the terminal.
- **Detector Calibration level** shows the power level used for calibrating the power detector in this tuning procedure.
- **Tx Calibration level** shows the power level used for calibrating tx frequency in this tuning procedure.
- In the *Measured Power Levels* pane, you can insert the dBm values read from the power meter.
- In the *Tuned Values* pane, the values that are stored in the permanent memory (PM) of the terminal in Current columns are shown.
- New values are added to *New* column when the **Calculate** button is clicked.
- The **Abort** button aborts the tuning operation without saving the tuned values.
- The **Read** button reads the tuned values in the PM of the terminal, and displays them in the *Tuned Values* pane in in the *Current* column.

Steps

1. Start *Phoenix* service software.

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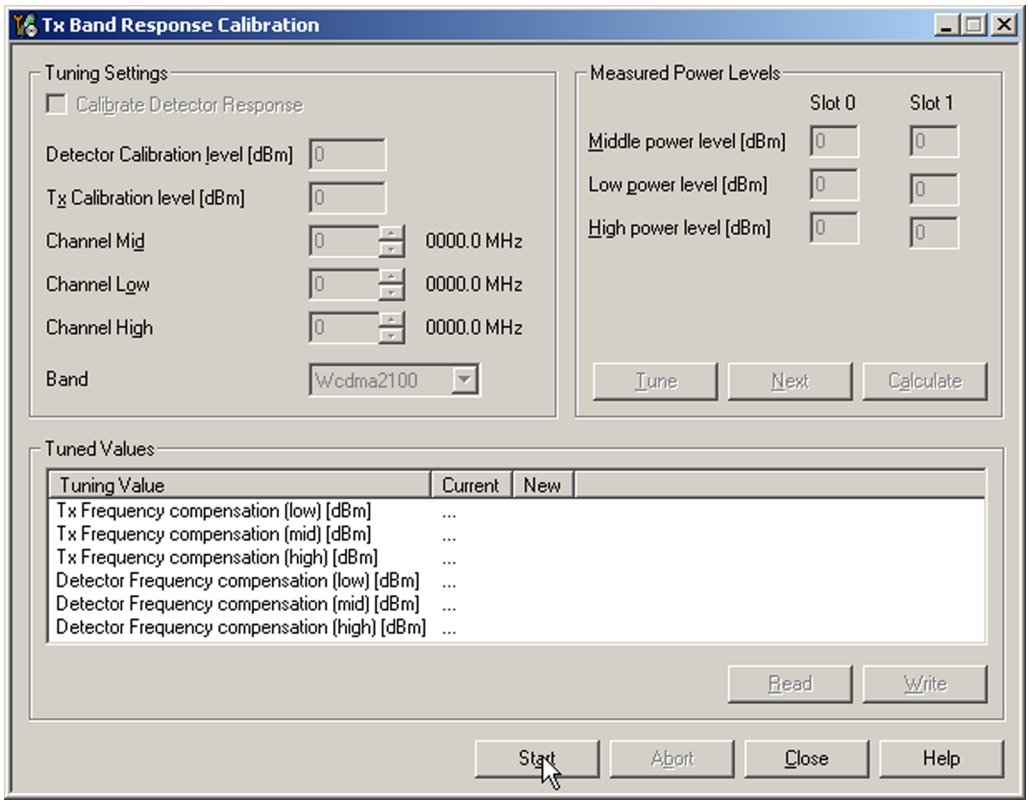
2. Choose **File→Scan Product** .
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→WCDMA→Tx Band Response Calibration** .
5. Click **Start**.



The current values are shown in the *Tuned Values* pane.

6. Click **Tune**.
7. Connect the power meter to the terminal, and set it to **Channel Mid** frequency.
8. Read the values of slot 0 and slot 1 from the power meter and enter them to **Middle power level** fields in the **Measured Power Levels** pane.

   Slot 0 is used for detector calibration and slot 1 for Tx calibration.
9. Click **Next**.
10. Switch the power meter to **Channel Low** frequency.
11. Read the values from the power meter, and enter them to **Low power level** fields.
12. Switch the power meter to **Channel High** frequency.
13. Read the values from the power meter, and enter them to **High power level** fields.
14. Click **Next**.
15. Click **Calculate**.

    The tuned values are shown in the *Tuned Values* pane in the *New* column.
16. Check that the tuned values are within the limits presented in the following table. If they are OK, click **Yes**.

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	Min	Max
Tx Freq Comp (the first and last value)	-4	+4

17. To save the tuned values to the terminal, click **Write**.
18. Close the *Tx Band Response Calibration* window.

Tx LO leakage (WCDMA)

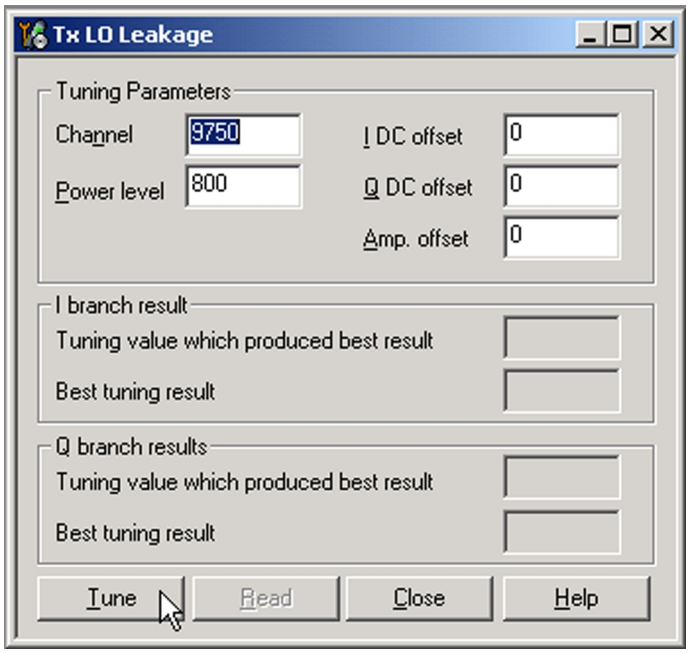
Context

The purpose of Tx LO leakage tuning is to minimize the carrier leakage of the IQ-modulator which is caused by the DC offset voltages in the Tx IQ-signal lines and in the actual IQ modulator.

The tuning improves WCDMA Tx AGC dynamics at low power levels. A self-calibration routine selects the best combination for internal control words in order to produce minimum LO leakage.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→WCDMA→ Tx LO Leakage** .
3. Click **Tune**.



4. To end the tuning, click **Close**.

Checking antenna functionality

Antenna overview

1. Cellular antenna

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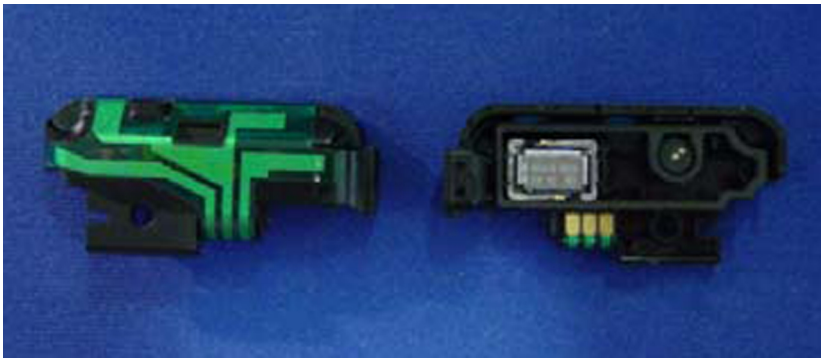

Figure 36 Cellular antenna

1.1. Cellular antenna description

- The phone has one main Cellular antenna covering all GSM and WCDMA bands.
- The antenna is located at the bottom of the product in the keypad area.
- The antenna comprises a plastic antenna carrier and a flexi circuit foil. The antenna has 3 connections, one is the feed to the antenna and the other two are ground connections for parasitic elements.

1.2. Cellular antenna fault finding

- The antenna can be checked using the RF test coupler provided. The measurement should be compared to a known working phone. Make the comparison at the GSM1800 band (any freq point will do).
- Please refer to the section on testing using a coupling jig below for more detailed information on good testing techniques.

2. Recommendations for using an RF coupler

All coupler measurements should be done as a relative measurement (i.e. compared with a known working phone). An RF coupler is a radiated measurement; as such objects near the measurement can change the results.

Anything metallic or lossy will alter the results if placed nearby including the following;

- Hands
- Antistatic mats
- Antistatic bags
- Metal including tools and table legs etc.

You need to put the test jig on something like a bench or an antistatic mat. This does not matter as long as the jig is kept in the same place as when the reference measurement was done.

To perform a series of measurements do a reference measurement on a known working phone and note down the coupling loss. Then do measurements on the phones under test and compare it to the reference phone. Repeat the reference measurement every time you move the jig or if you start to see drift in the results.

The antenna under test should be within 3dB of the reference antenna using the method described above. If it is not repeat the reference measurement to check, then check the RF output power.

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3. Non cellular antennas

Figure 37 Non cellular antennas and contact areas

3.1. Non cellular antenna description

- The phone has three non cellular antennas mounted in the B cover of the phone.
- At the top of the phone near the power on/off key is a combined BT/WLAN antenna. This antenna has 1 feed C clip pin and 1 grounded C clip pin.
- At the top of the phone near the lock switch is the GPS antenna. This antenna has 1 feed and 1 ground C clip connection.
- The FMTx antenna is also mounted in the B cover. It has 1 feed spring contact connection and 1 ground spring contact connection that mates to the engine PWB.

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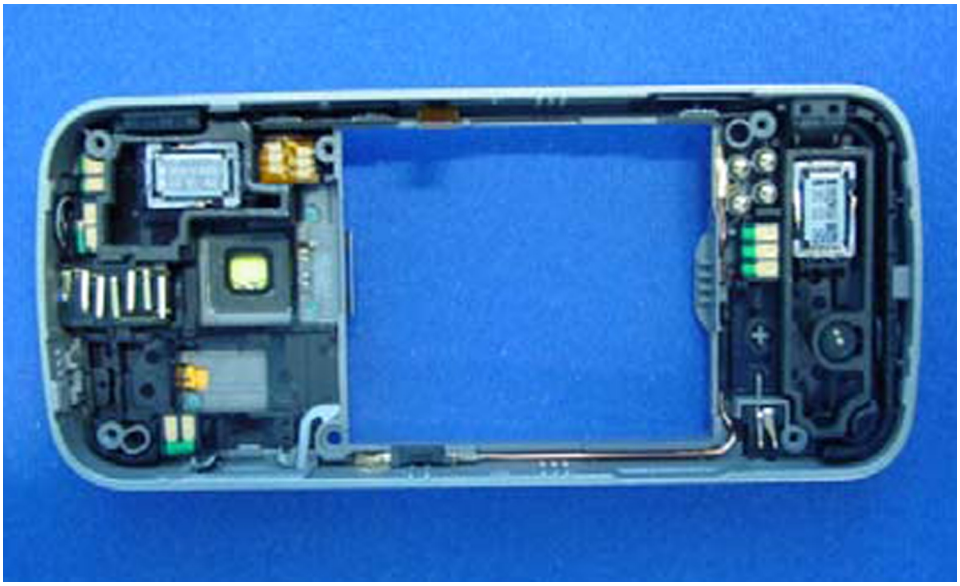

Figure 38 FMTx antenna

3.2. Non cellular antenna fault finding

- The NCW antennas are in the B cover. This should be inspected visually. Especially check the contact areas for dirt. Some denting of the contacts areas is expected and should not cause a problem.
- Please refer to the RF section for fault finding information for the GPS, WLAN and BT systems.

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5 — Camera troubleshooting

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Camera subsystem

Introduction

The camera subsystem contains the complete imaging system for the main 5 megapixel AF camera and the 400X400 pixel front camera.

Key components

- DM500 Processor

Controls the 5 Mpixel AF main camera and the 400X400 pixel front camera (Image capture & Image Quality enhancements).

> **Note:** There is no non-volatile memory (Flash or ROM) for the DM500. Initialization code is passed from the RapidoYawe at power up via the SPI interface. Further application code (self-test, image capture, video capture) is transferred depending on the usage case.

Video and still image data is passed to the Rapido for display & storage after processing over a CCP bus (CCP_CMT). Rapido provides the main clock, reset and wake up signals to DM500. The accelerator generates an interrupt to the host itself. DM500 has internal 128Mbit DDR RAM for buffering captured image data & code storage.

- Flash LED and Privacy LED

Camera flash LED and Privacy LED controlled from the DM500 via the ADP1653 AD driver. Driver has GPIOs control for STROBE, ENABLE, FLASH_FAULT, ANALOG control for FLASH current (TX_MASK) and I2C bus control for configuring.

- 5 Mpixel Camera Module

The camera module is configured by the DM500 using I2C (I2C HIRES) control bus. It includes an EEPROM with calibration values. Image data is transferred to the DM500 over a CCP balanced bus (HIRES_CCP). DM500 also provides the generation of external clock for the camera (HIRES ExtClk).

- 400X400 Pixel Front Camera

The camera module (400X400 pixel module) is configured by the DM500 using I2C (I2C LORES) control bus. Image data is transferred to the DM500 over a CCP balanced bus (LORES_CCP). DM500 also provides the generation of external clock for the camera (LORES ExtClk).

- 3 Axis Accelerometer

The display orientation is provided by a 3 Axis ±2g/±8g (selectable range) accelerometer (LIS3L02, STM). The sensor generates an interrupt directly to Rapido host and communicates data by an I2C bus.

Powering

The camera subsystem is powered with discrete regulators (1V3, 1V8, 2V8 and 3V0). 1V3 is created by LP5952 LDO power supply, Vin is connected to 1V8 output. 1V8 is created by LM3677 SMPS power supply, Vin is connected to VBAT. 2V8 and 3V0 are created by LP3985 LDO regulators, both with Vin connected to VBAT. These supplies are turned off when the camera is not used with single GPIO controlled by Rapido host. The LED driver (ADP1653) is supplied by the battery voltage Vbat.

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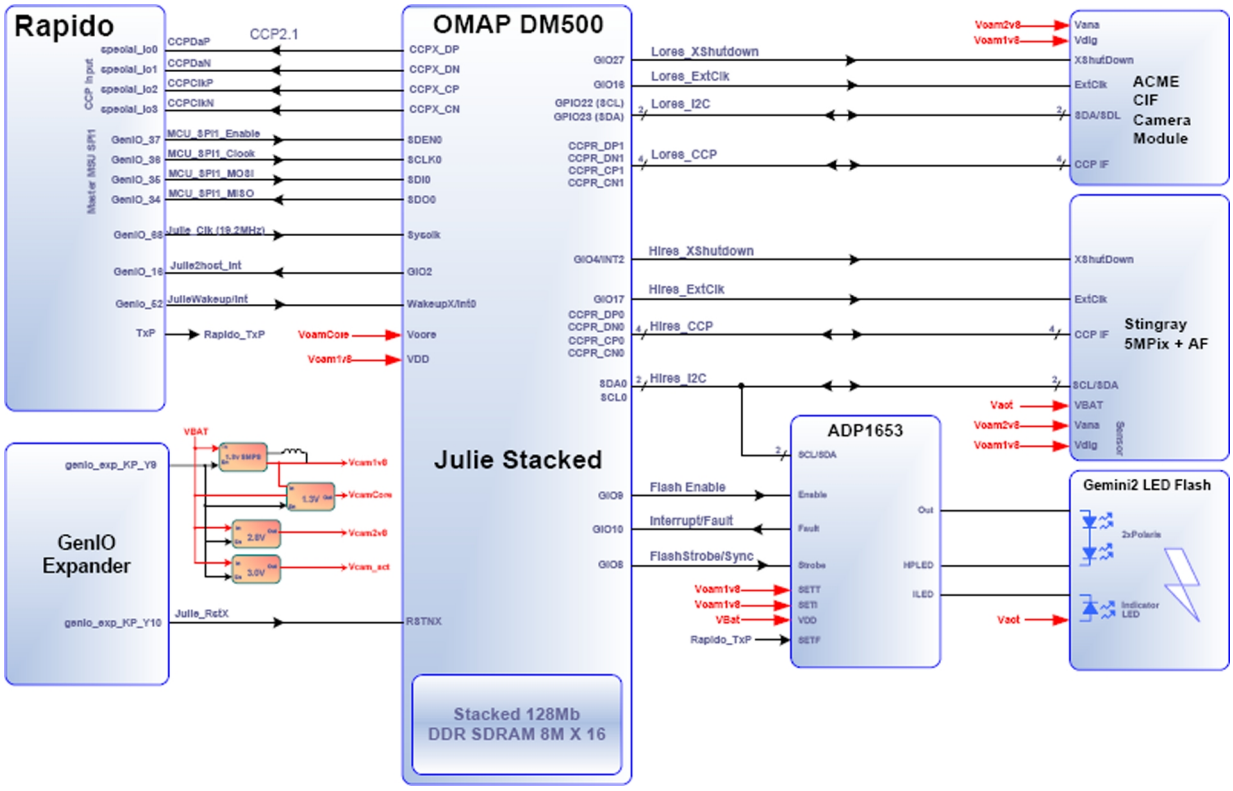

Figure 39 Camera block diagram

Camera and accelerator layout

The key components in the layout picture are accelerator (N1400), power supplies (N1402, N1403, N1404, N1449), 5M camera (X1450), secondary camera (N1450) and flash LED driver (N1007).

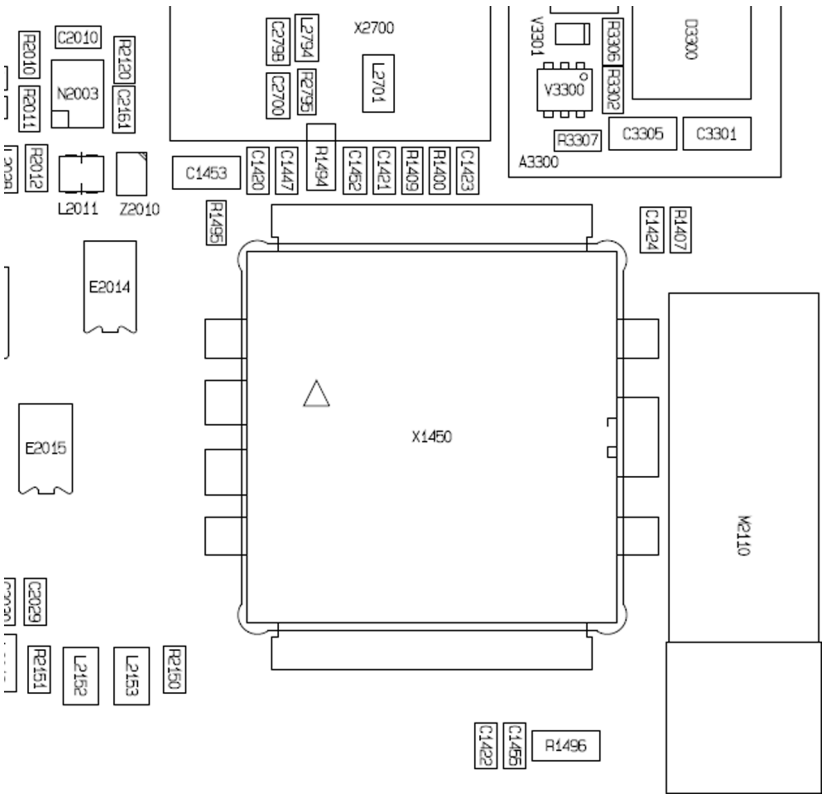

Figure 40 Camera layout

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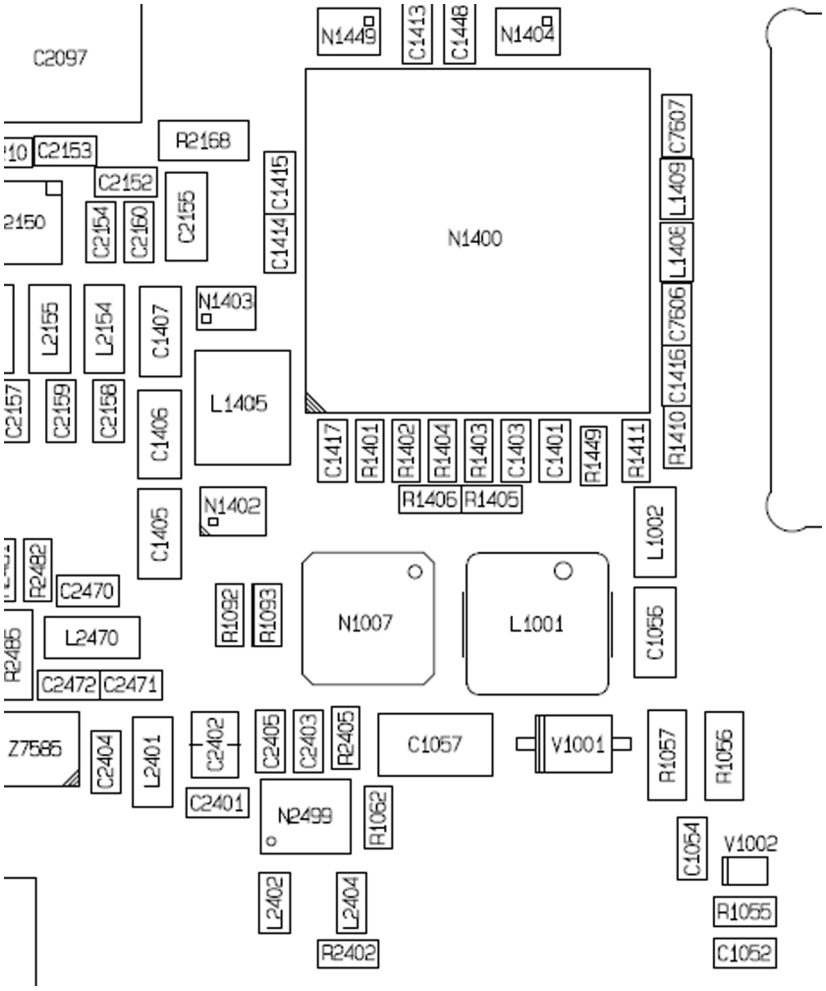

Figure 41 Accelerator layout

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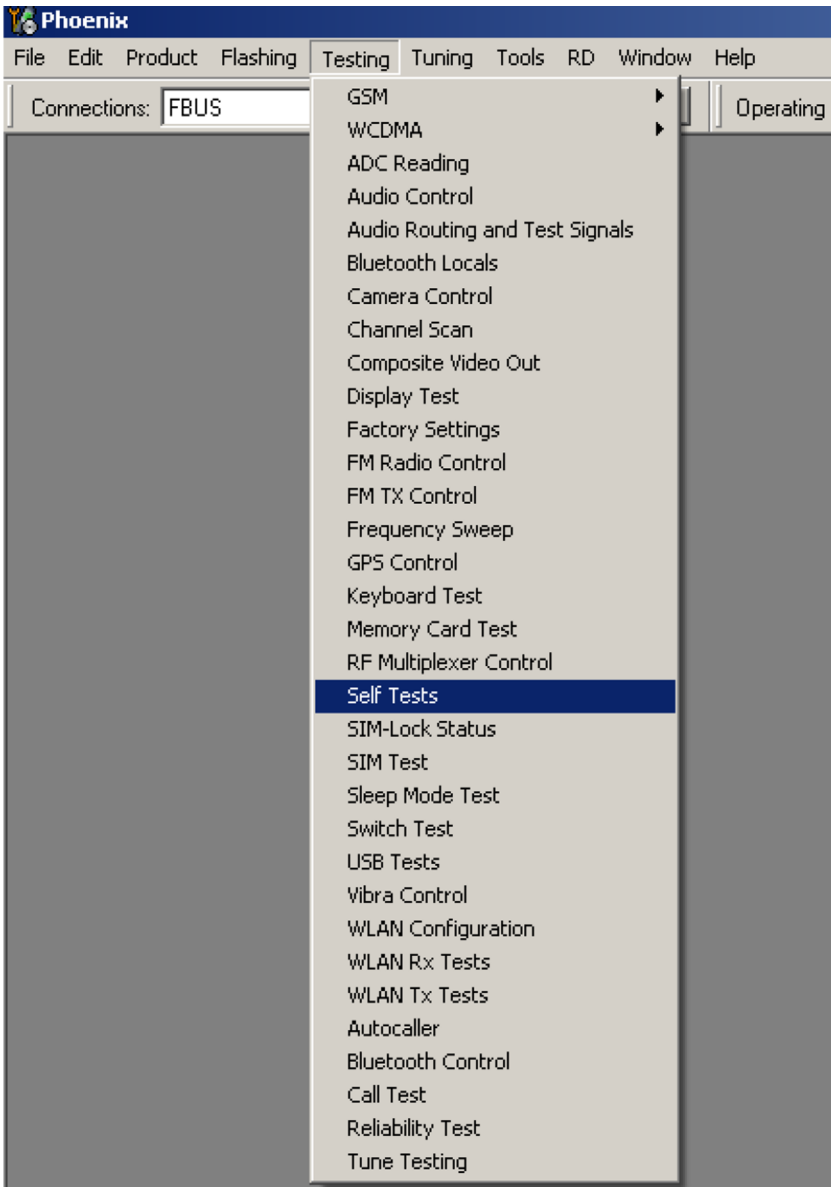
Camera tests for Phoenix

Steps

1. Selftests can be executed from Phoenix test software. Connect product to Phoenix, and select Testing > Self Tests from menu.



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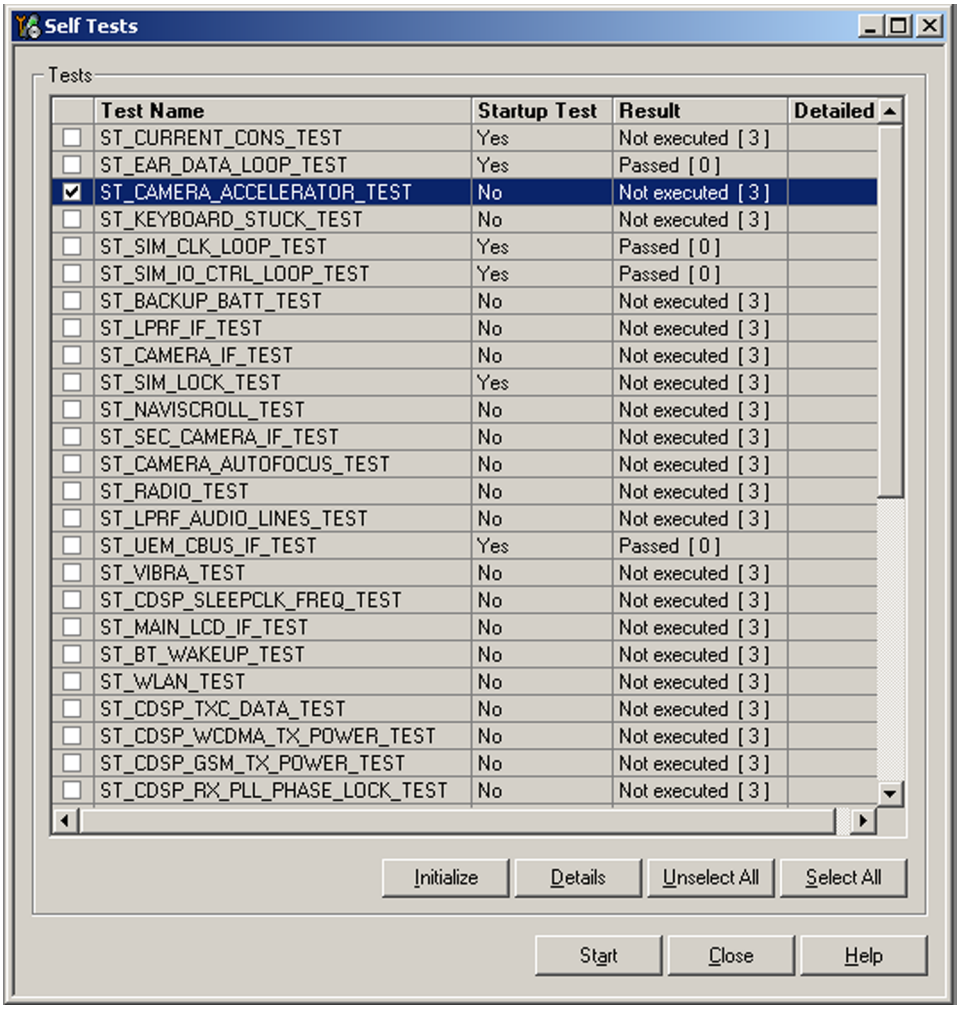
2. Following selection of tests will open (this will depend on product what will be visible).



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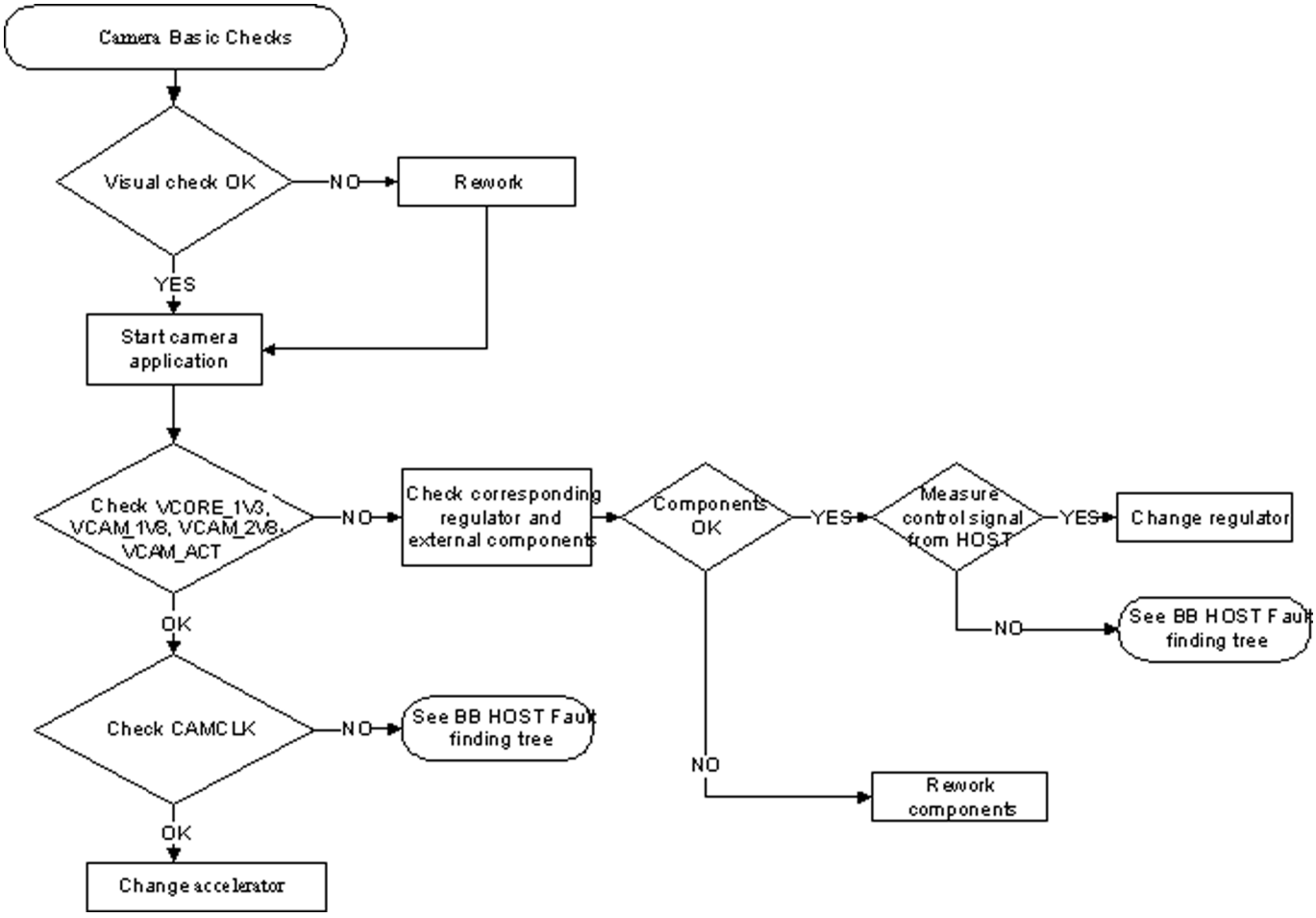
Camera basic check troubleshooting

Troubleshooting flow



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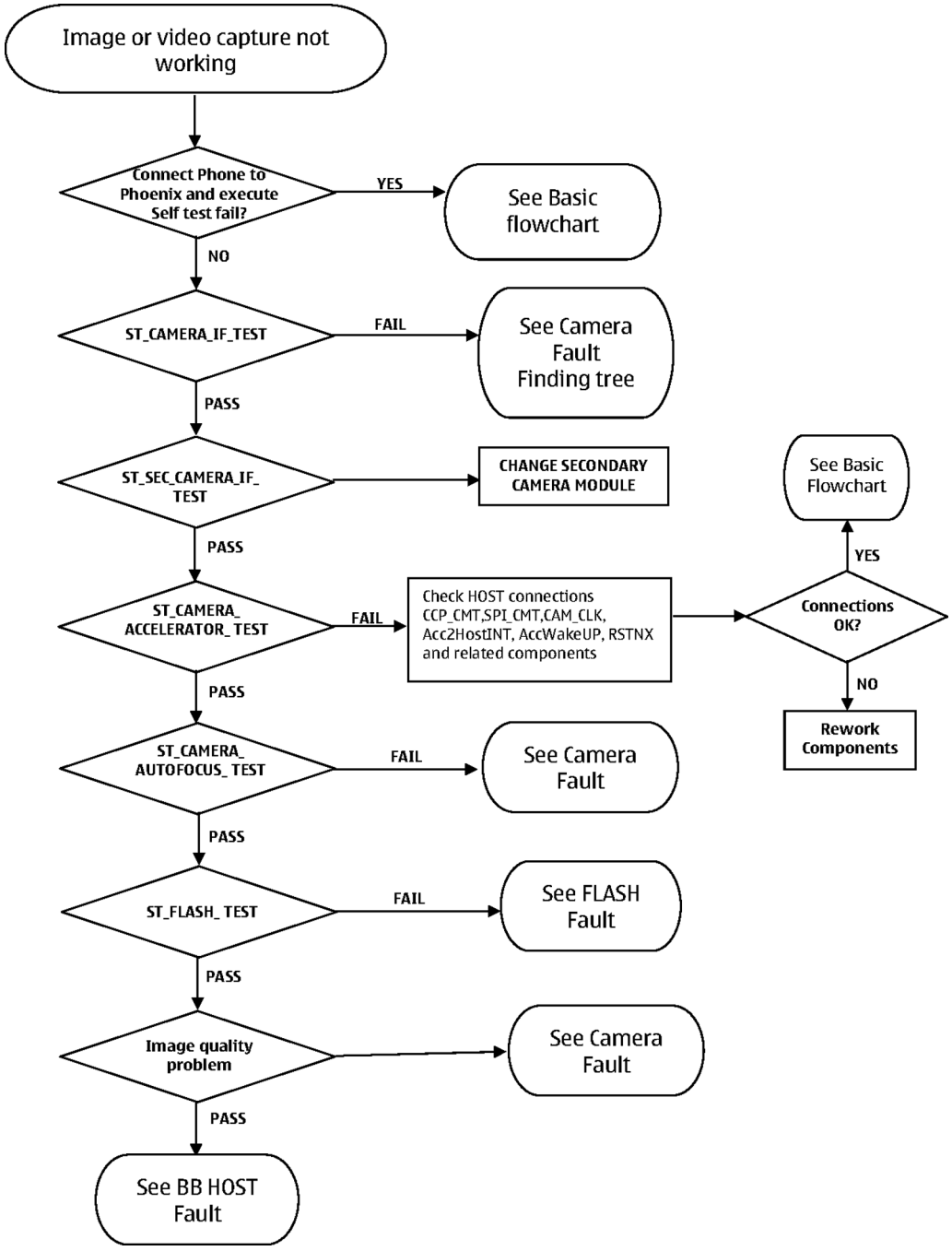
Camera failure troubleshooting

Troubleshooting flow



Flash troubleshooting

Context

Note: Before checking flash functionality, make sure that the main camera is working ok.

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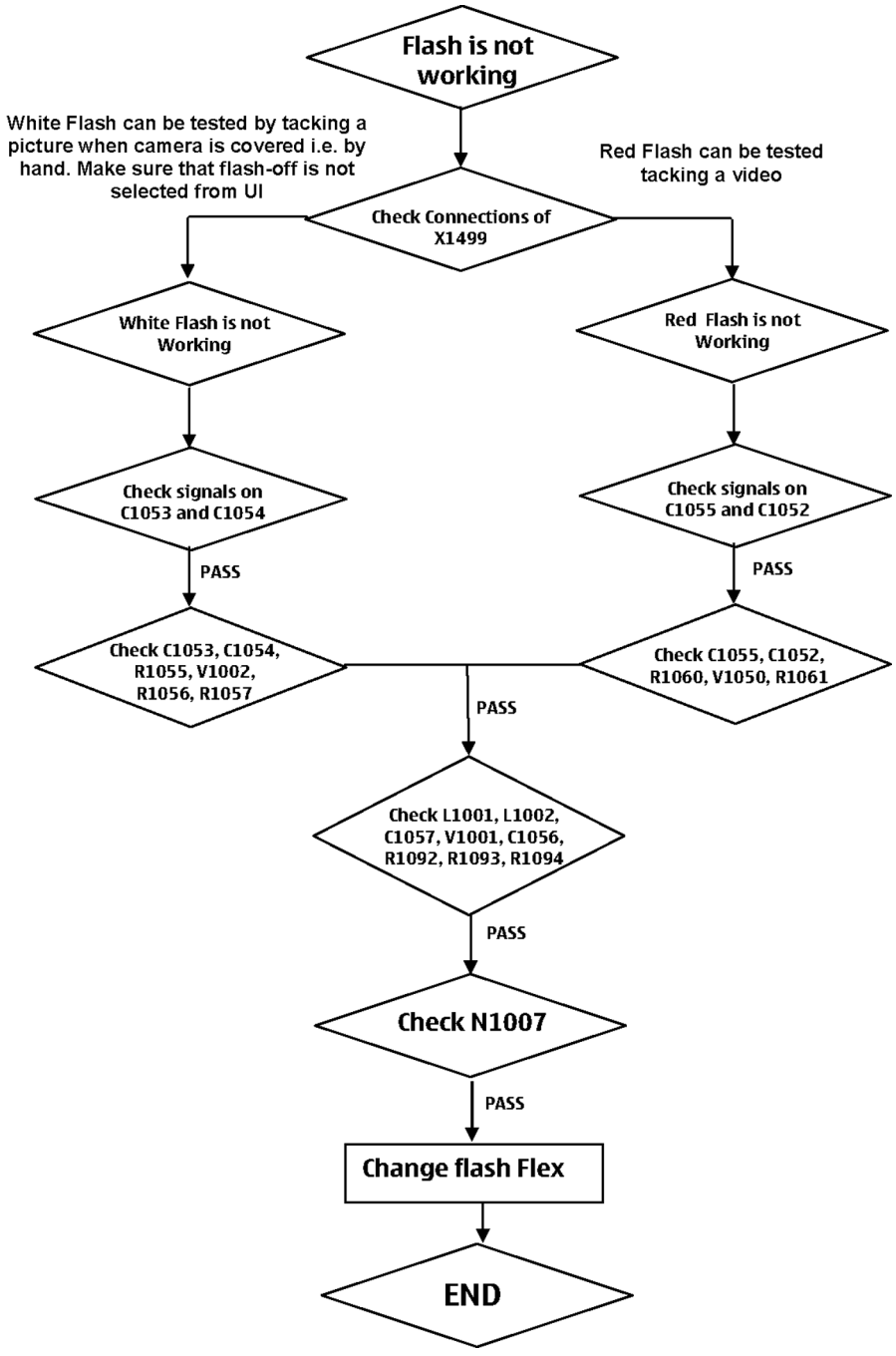
Troubleshooting flow



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6 — FMTx 2.0 Technical Description

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Glossary

AF	Audio Frequency
RF	Radio Frequency
FM	Frequency Modulation
Tx	Transmitter
Rx	Receiver
FMTx	FM Transmitter
LPD	Low Power Device
LNA	Low Noise Amplifier
LDO	Low Drop Out regulator
RSSI	Received Signal Strength Indicator (same as RPS)
RPS	Received Power Scan (Same as RSSI)
QFN	Quad Flat No-Lead

FMTx2.0 HW block

The FMTx 2.0 implementation is based on the Silicon Laboratories Si4713 low power FM transmitter device. This device has some state of the art features which have been utilised in the Nokia implementation. Apart from having excellent RF transmitter performance and exceptional AF performance the device offers a number of unique features, including the ability to retune the output stage of the device to ensure optimal matching between the Tx antenna and the output stage of the device.

Functional description

The FMTx 2.0 solution comprises of the Si4713 device and ten external components. These components consist of:

- A filter - an inductor and a varistor for filtering of emissions from the chip
- A dual capacitor package which is connected to the analogue audio input pins LIN & RIN. The fundamental purpose of these capacitors is as DC blocking caps
- A filter on the reset line comprising a capacitor and a resistor
- An antenna which also provides the inductive load required by the Si4713 device

The Si4713 device is in a 3 x 3mm 20 pin QFN package.

Current implementations make use of the DAC33 device which allows data to be digitally clocked into the DAC at high data rates, buffered and then streamed out at the correct rate while the rest of the baseband is put to sleep in order to save power. This solution significantly increases playback time of audio content.

The Si4713 device has the following features:

- 88.1MHz – 107.9MHz FM band support.
- Programmable pre-emphasis (50/75us).
- Analogue audio interface
- Audio silence/signal present detection.
- Programmable reference clock.

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- RDS/RBDS encoder
- Loop and monopole antenna support with self-calibrated capacitor tuning.
- Programmable transmit level.
- Audio dynamic range control.

System block diagram

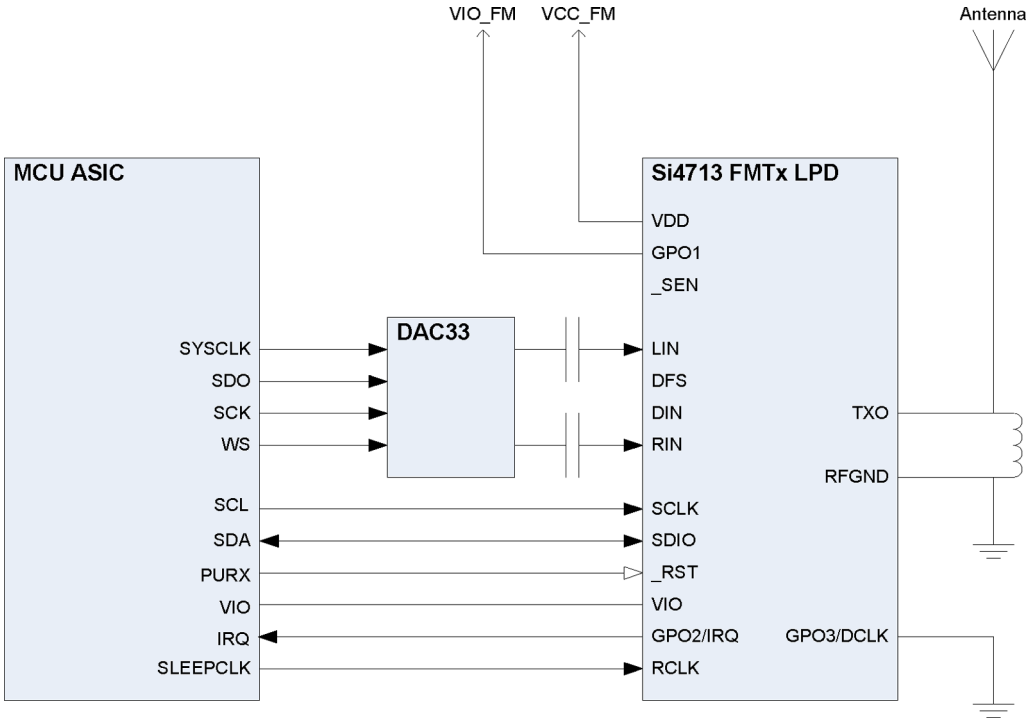

Figure 42 FMTx 2.0 system block diagram

The figure shows a basic system block diagram for the FMTx 2.0 implementation. _SEN is shown here unconnected since this pin decides which I2C address is used depending on if this pin is pulled low or high. On RM-348 the _SEN is pulled high by connecting it to VIO.

RM-348 uses a loop antenna which is buried in the B-cover of the device. The loop antenna also acts as the tuning inductor which is required by the Si4713 chip. The location of the antenna in the B-cover means that no ESD protection is required to prevent damage to the Si4713 device.

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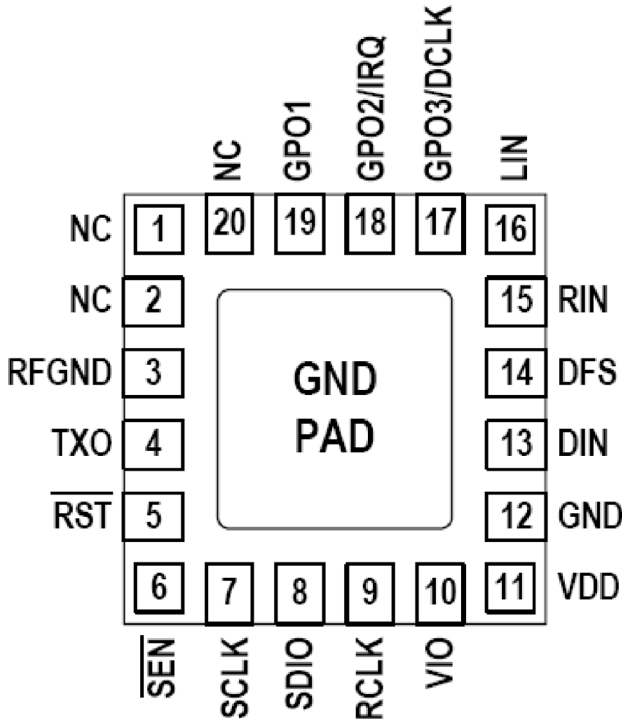
Device pin layout (Si4713-GM) and interfaces



Inteface pin descriptions

Pin Number(s)	Name	Description
1, 2, 20	NC	No connect, left floating.
3	RFGND	RF ground. Connected to ground plane on PCB.
4	TXO	FM transmitter output connection to Tx antenna.
5	RST	Device reset (active low) input.
6	SEN	Serial enable input (active low).
7	SCLK	Serial clock input.
8	SDIO	Serial data input/output.
9	RCLK	External reference oscillator input.
10	VIO	I/O supply voltage.
11	VDD	Supply voltage.
13	DIN	Digital input data.
14	DFS	Digital frame synchronisation.
15	RIN	Right audio line input.
16	LIN	Left audio line input.
17	GPO3/DCLK	General purpose output – Digital bit synchronous clock.

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Pin Number(s)	Name	Description
18	GPO2/IRQ	General purpose output – Interrupt request.
19	GPO1	General purpose output.
12, GND PAD	GND	Ground. Connect to ground plane on PCB.

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7 — FMTx 2.0 Troubleshooting

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FMTx 2.0 schematic

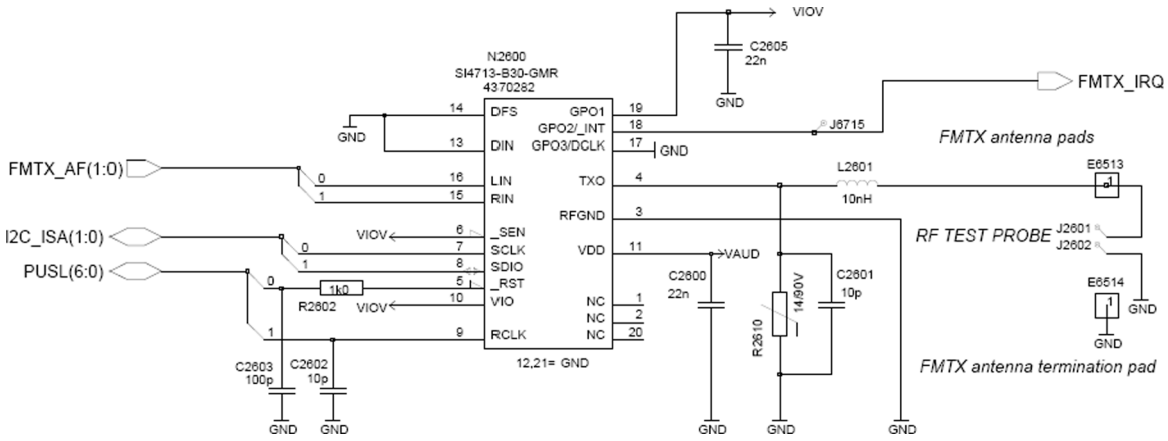

Figure 43 FMTx 2.0 schematic

FMTx 2.0 component layout

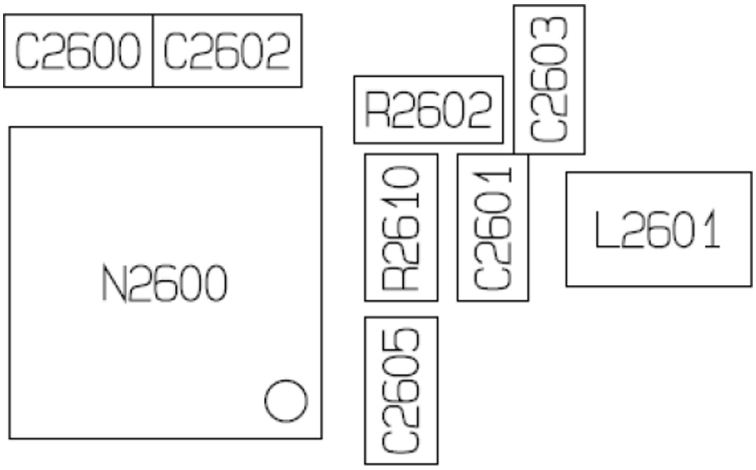

Figure 44 FMTx 2.0 Component References and Location

The main component of the FMTx 2.0 solution is the Si4713 low power transmitter device (N2600).

The figure below shows the layout of the DC blocking capacitors on the left and right audio path C2149 and C2148.

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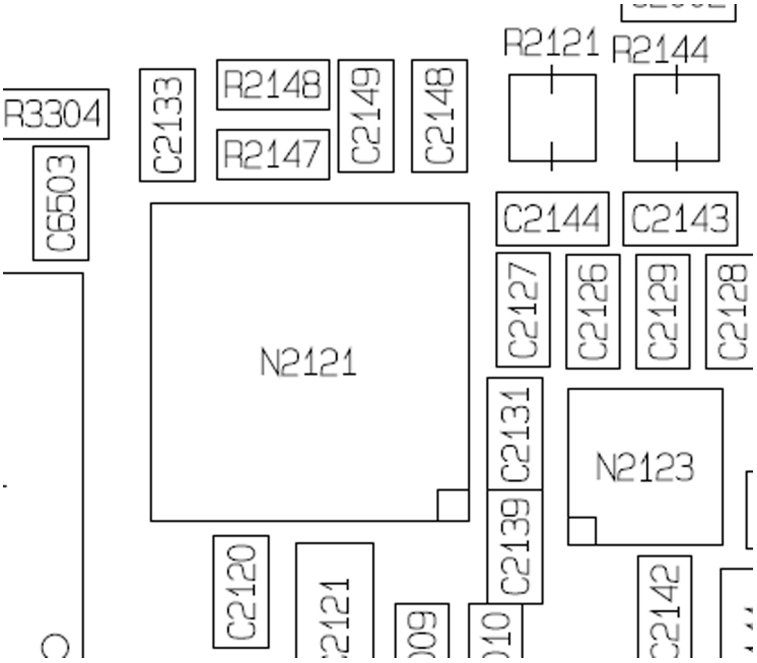

FMTx 2.0 PWB traces

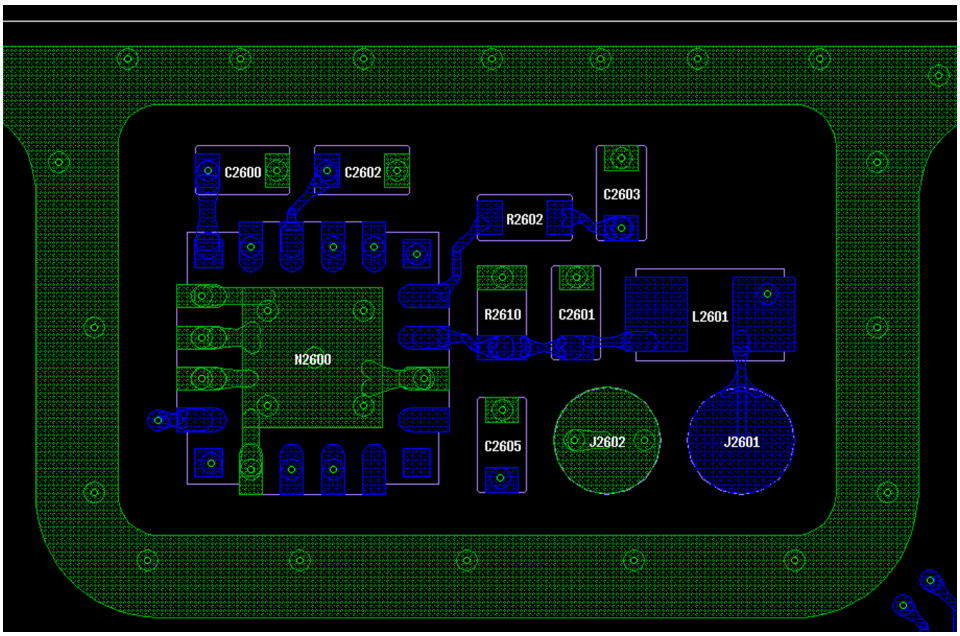

Figure 45 FMTx 2.0 layout (Layer 10)

Since the Si4713 device package that is used for the FMTx 2.0 solution is a QFN package, access to the various pins is good. There are however, a significant number of other access points available due to tracks running from the Si4713 device and also at the edges of some of the external components such as the inductor.

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Access to signals

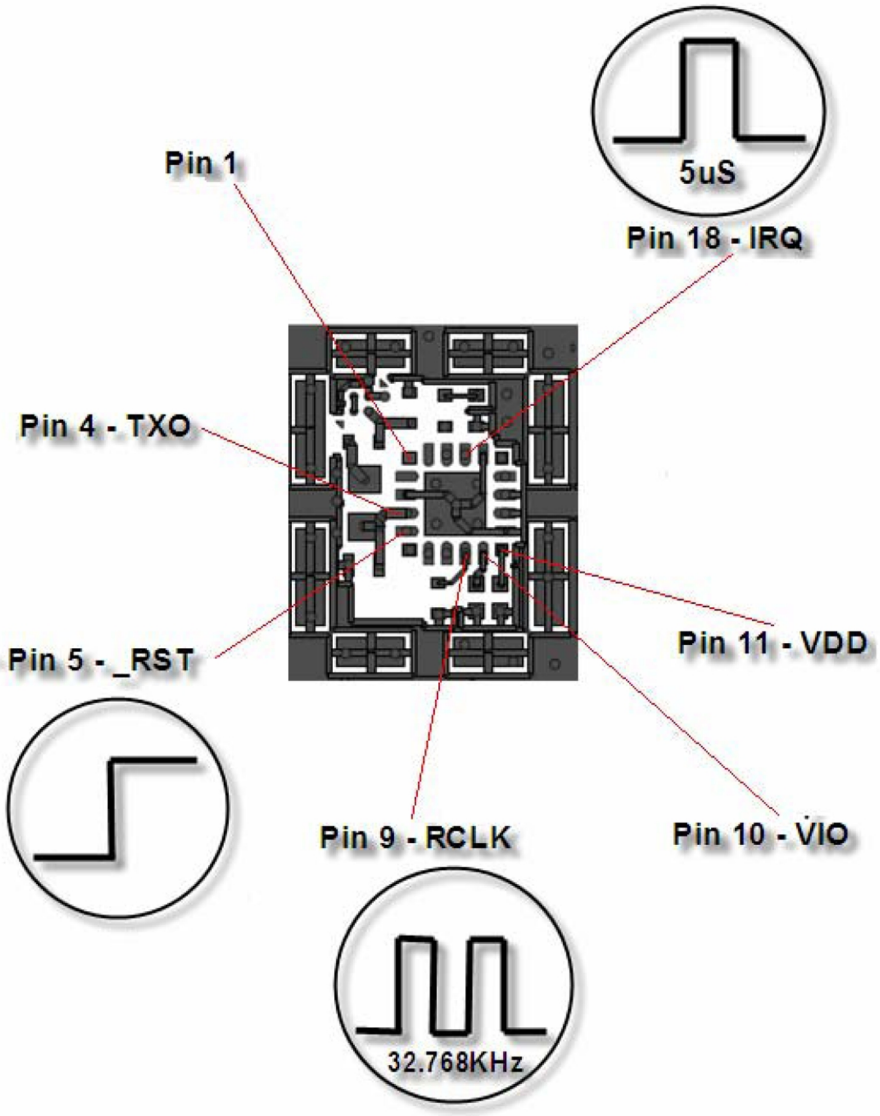

Figure 46 Access to signals

Note: Pin 1 has been indicated purely as a reference.

Figure shows possible access points for monitoring/measuring the various signals of the FMTx 2.0 solution. Typical voltage levels, waveforms and frequencies have been indicated where appropriate.

Specific digital and power supply test points

Using access to signals figure as a reference it can be seen that supplies to the Si4713 device VIO (pin 10) and VDD (pin 11) can be accessed easily. The FMTx 2.0 solution utilises a QFN package. This type of package lends itself well to analysis of signals on the various pins of the device.

VIO & VDD

VIO should be in the range 1.5 to 3.6 Volts.

VDD should be in the range 2.7 to 5.5 Volts.

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_RST

Also, the _RST signal to the device can be monitored. This is an active low signal and should only be asserted during power up. The _RST signal is driven by the PURX line.

The state of pins 19 & 18 (GPO1 and GPO2 respectively) on the rising edge of the _RST pin determines what interface is selected when the device powers up.

Table 12 Bus mode selection truth table.

Bus Name	Bus Mode	GPO1	GPO2/IRQ
I2C	2-Wire	High	Low
SPI	SPI	High	Low (must drive)
CBus	3-Wire	Low (must drive)	Low

It's possible that if GP01 and/or GPO2 are not at the correct state when the Si4713 device has power applied then the wrong bus mode could be selected and the handset would be unable to communicate with the device. For RM-348, the bus mode should be I2C.

_SEN

The _SEN pin is used to select one of two possible 7-bit I2C bus addresses. When _SEN is low, the I2C bus address for the Si4713 device is 0010001 (0x11). When _SEN is high, the I2C bus address for the Si4713 is 1100011 (0x63).

If the _SEN signal is not correct (i.e. not selecting the correct I2C address), then this is also another possible reason why control of the FMTx 2.0 feature might not be possible. For RM-348 the I2C address used for FMTx 2.0 will be 0x63.

Table 13 I2C 7-bit bus address selection summary

I2C address	_SEN
0010001 (0x11).	Low
1100011 (0x63).	High

FMTx2.0 specific RF test points

TXO

Pin 4 is the TXO pin. This is the transmitter output pin and probe access can be obtained easily on one side of the large inductor component. (L2600 – see figure 2). Using a high impedance probe and a spectrum analyser it would be possible to examine the TXO pin and check that the transmitter is outputting a signal.

Specific clock test points

RCLK

Pin 9 is the RCLK (Reference Clock) input to the device. This is typically 32.768KHz and is driven from the sleep clock from the base band. When measuring this clock frequency, it may be seen to vary by as much as +/- 120 ~ 200ppm. The device can only typically tolerate +/- 20ppm in order to maintain transmit frequency accuracy. To overcome this, the software driver for the device calculates what the actual sleep clock (RCLK) frequency is and periodically programs the device with this frequency.

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The device then internally adjusts its dividers in order to maintain the required output frequency. Using this method it is possible to reduce the effective ppm of the reference clock down to +/- 14ppm over the full operating temperature range of -15 to +50 degrees Centigrade.

General visual inspection guidelines

- Check that the Si4713 device is placed correctly on the PWB and that there are no obvious signs of damage.
- Check the surrounding components and ensure correct placement on the PWB and that there is no visual damage. Check that there are no missing components.

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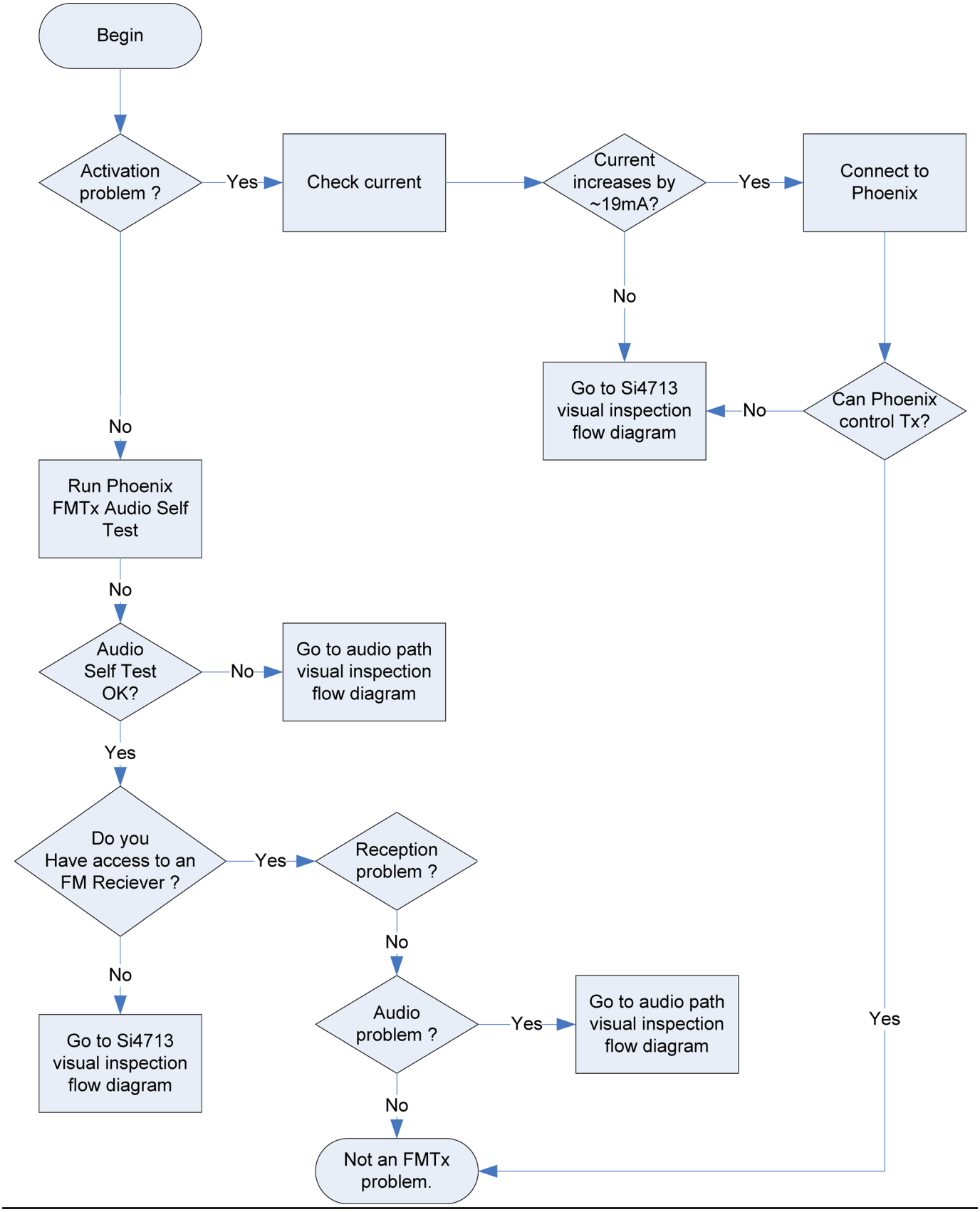
FMTx2.0 troubleshooting

Troubleshooting flow



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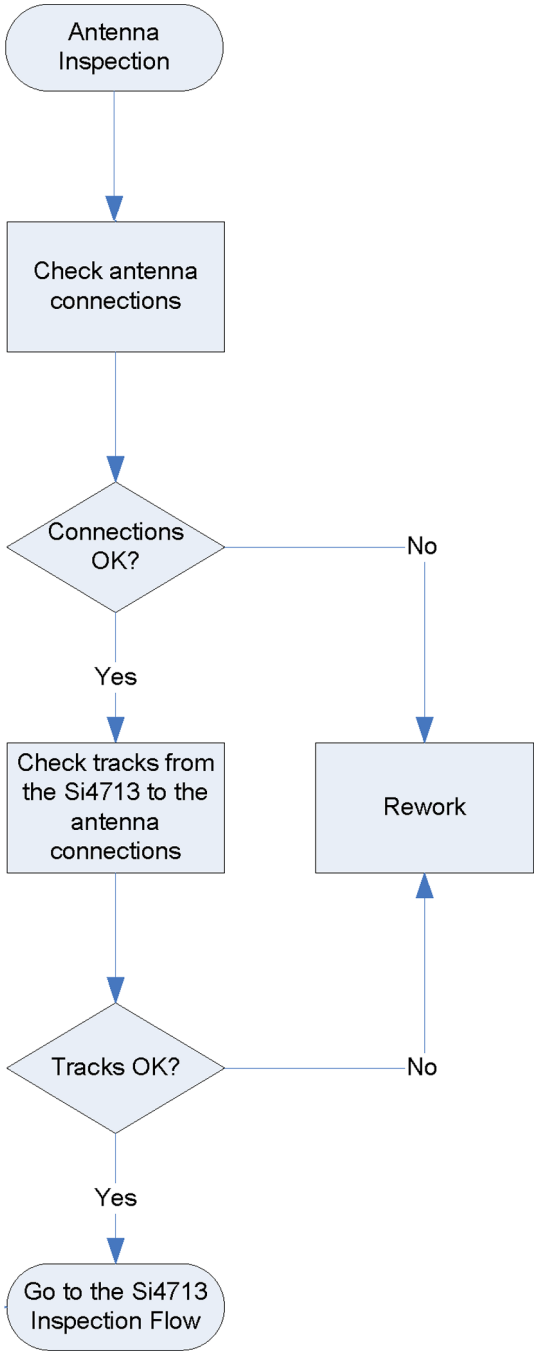
FMTx2.0 antenna visual inspection troubleshooting

Troubleshooting flow



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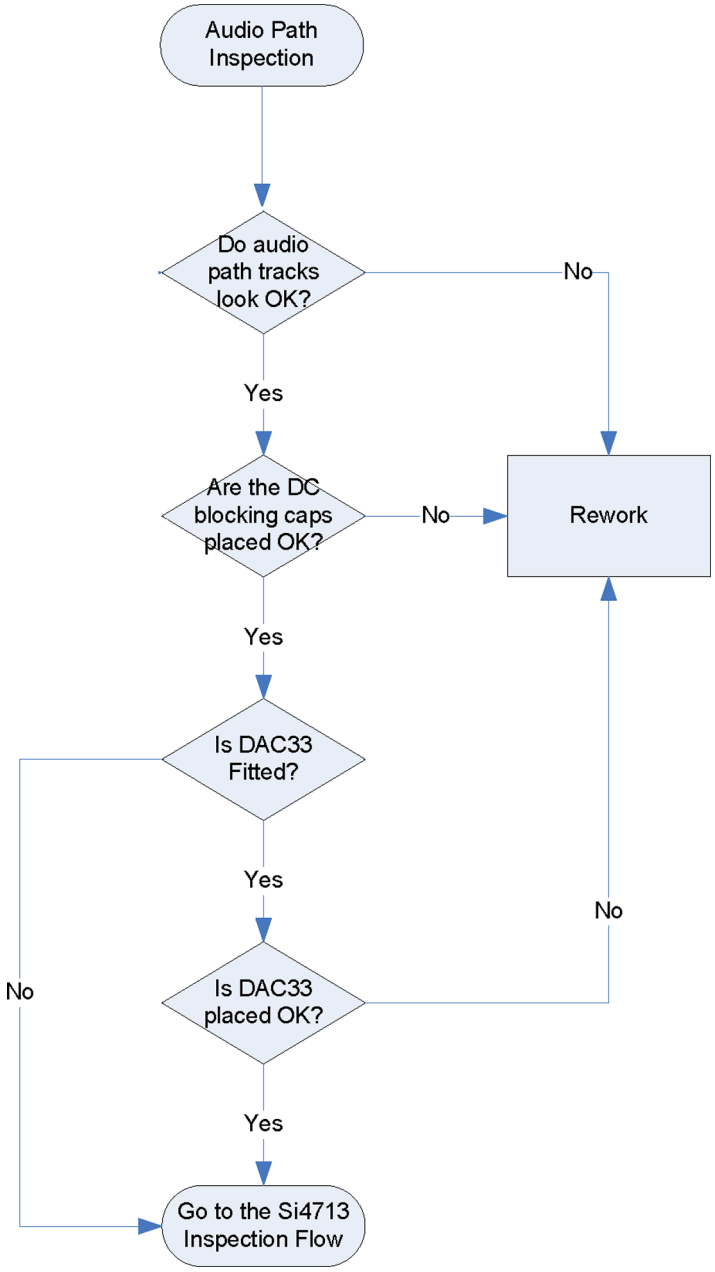
FMTx2.0 audio path visual inspection troubleshooting

Troubleshooting flow



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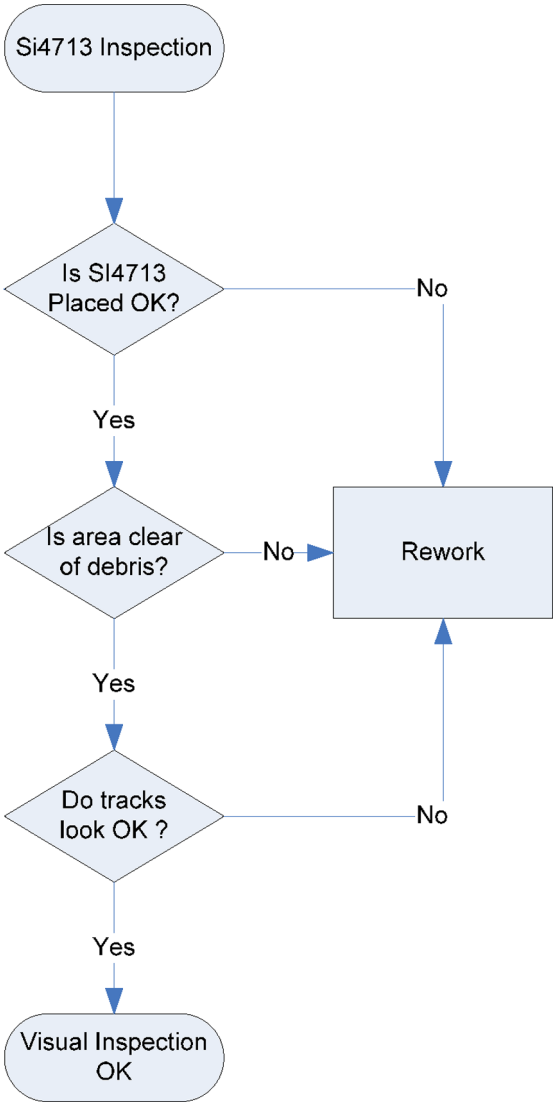
FMTx2.0 Si4713 visual inspection troubleshooting

Troubleshooting flow



Checking validity of signals

Please refer to **Access to signals** figure as a reference. Generally all power supply levels and clocks willbe consistent. Signals on the analogue audio input pins (RIN & LIN – pins 15 and 16 respectively) will be dependant on the audio content being injected to the device. During the audio self test (initiated from Phoenix) it is possible to monitor these pins and check that the DSP generated 1KHz tones can be seen at some point during the test. Check that the signals are clean and that no obvious distortion can be seen such as clipping of the signals. Typical maximum swing of these tones will be ~636mV peak to peak. The maximum swing may vary between Nokia handsets but for the FMTx 2.0 implementation, the swing should not be greater than the aforementioned value.

FMTx2.0 troubleshooting faults

Possible faults

Expected fault reports relating to the FMTx 2.0 implementation may consist of one or more of the following;

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1 No left audio.
2 No right audio.
3 No audio.
4 Can’t start FMTx.
5 Can’t locate FM transmission on an FM receiver or no FM transmission.
6 Distortion on audio.
7 Poor reception on FM receive.r
8 No RDS information.

Initial fault analysis

Where possible, attempt to reproduce and verify the reported fault. Intermittent problems are likely to be due to bad connections or broken components/solder joints. Any faults relating to poor FM transmitter performance or frequent failure to locate usable frequencies when performing a scan are likely to be due to some kind of antenna issues.

In handsets that utilise an antenna solution in a removable cover it is likely that the connecting interface pins are either damaged, dirty or that the cover fits poorly perhaps due to broken tabs/latching lugs. Poor audio fault reports may also be due to the above antenna issues.

Phoenix PC tool

Setting Up Phoenix

Required equipment;

- A Deskey security dongle for Phoenix to run.
- The latest version of Phoenix that has the FMTx 2.0 GUI installed on a PC (version 2007.21.000.27897 or greater).
- A jig suitable for the handset.
- A cable to connect the jig/handset to the PC. Run Phoenix and select the FMTx panel.

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Using the FMTx panel to drive the FMTx 2.0 features

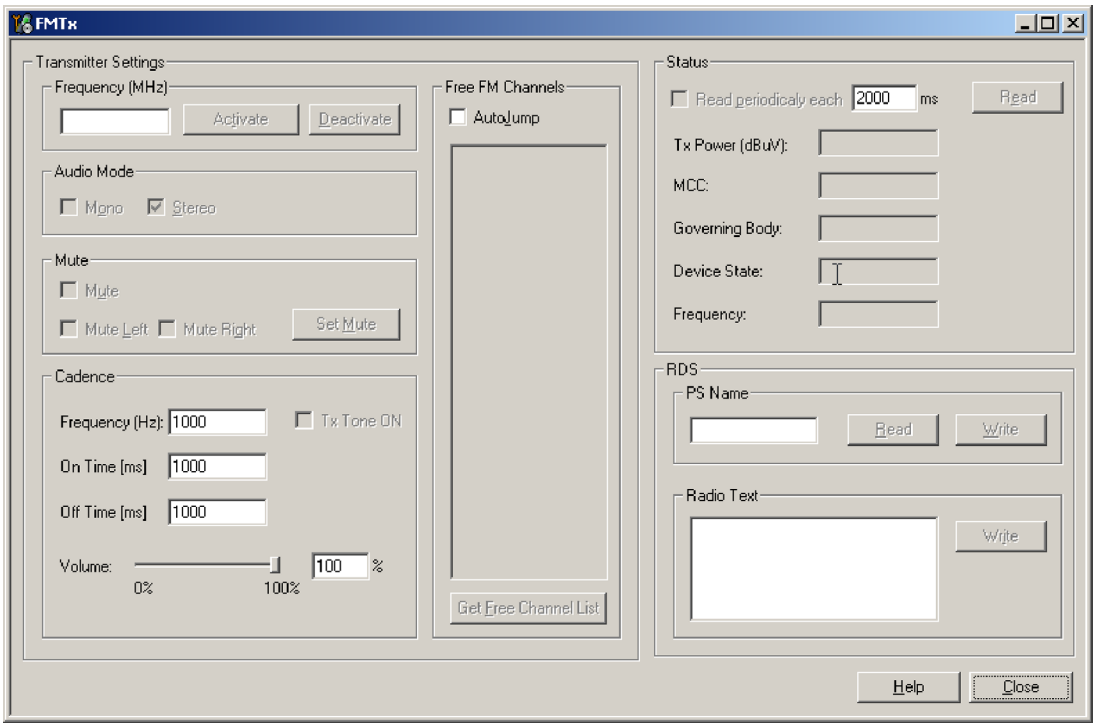

Figure 47 FMTx panel before connection to the handset

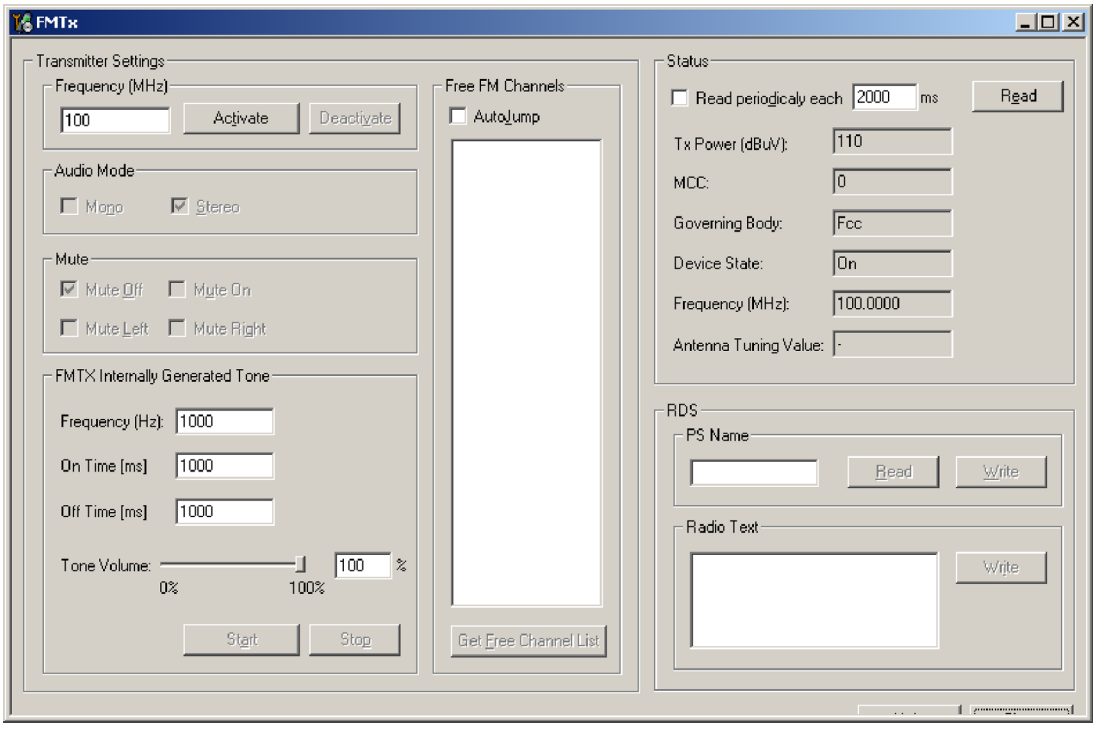

Figure 48 FMTx panel after connection to the handset

Typing in a valid FM transmitter frequency and clicking on 'Activate' will turn on the FMTx feature and will begin transmitting the carrier on the selected frequency. Note: Unless this carrier signal is modulated with some audio (either via the music player or a DSP or Si4713 generated tone) then all that will be heard if an

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FM receiver is tuned to the same frequency would be silence. After approximately 10 seconds of silence the handset should begin to 'chirp' periodically with a short 1Khz tone that repeats every 5 seconds. This indicates that there is no audio input and reminds the user that the feature is on.

The Phoenix FMTx 2.0 panel can be used to control the following features;

- Set the FM frequency to transmit on (88.1 to 107.9MHz).
- Select Stereo or Mono mode (generally all Nokia handsets will only use stereo)
- Mute both left and right audio channels.
- Mute only the left or the right audio channels.
- Allow an internal tone to be generated and transmitted from the Si4713 device. The audio frequency of this tone can be selected along with the on/off time and the volume of the tone. Selecting 0 (zero) in either the on or off time will produce a continuous tone.
- Obtain a list of suitable 'quiet or free' channels. This effectively performs an RSSI (RPS) scan to locate quiet channels to transmit on. If the 'AutoJump' tick box is checked then this list will be transmitted to the FM receiver to allow the handset to perform AF jumps. This is dependent on the Nokia handset and if the FM receiver is RDS capable. The use of AF feature allows an RDS capable FM receiver to follow the transmissions of the FM transmitter automatically.
- FMTx 2.0 status panel. This provides information on the state of the FMTx feature. This can be polled by Phoenix at regular intervals defined by the user when the 'Read periodically each…' check box is checked. The status can otherwise be read at any point by clicking on the 'Read' button. The MCC value is the 'Mobile Country Code' and provided the phone is registered on a network will provide the code pertaining to the country in which it resides. The antenna tuning value is a good indicator of the state of the antenna and the other components connected to the TXO pin. The tuning values should be in the range 0 – 80. Any value outside of this range will indicate some problem with the components connected to the TXO pin (including the antenna). In the case of a removable antenna, the cause of the out of range value is like to be because of a poor antenna connection. This might be because of broken or dirty connections between the handset and the cover in which the antenna is fitted.
- The RDS panel can be used to set the PS name and/or to enter a Radio Text (RT) string. If access to an FM receiver is available that supports RDS then these strings can be observed on the display of the FM receiver.

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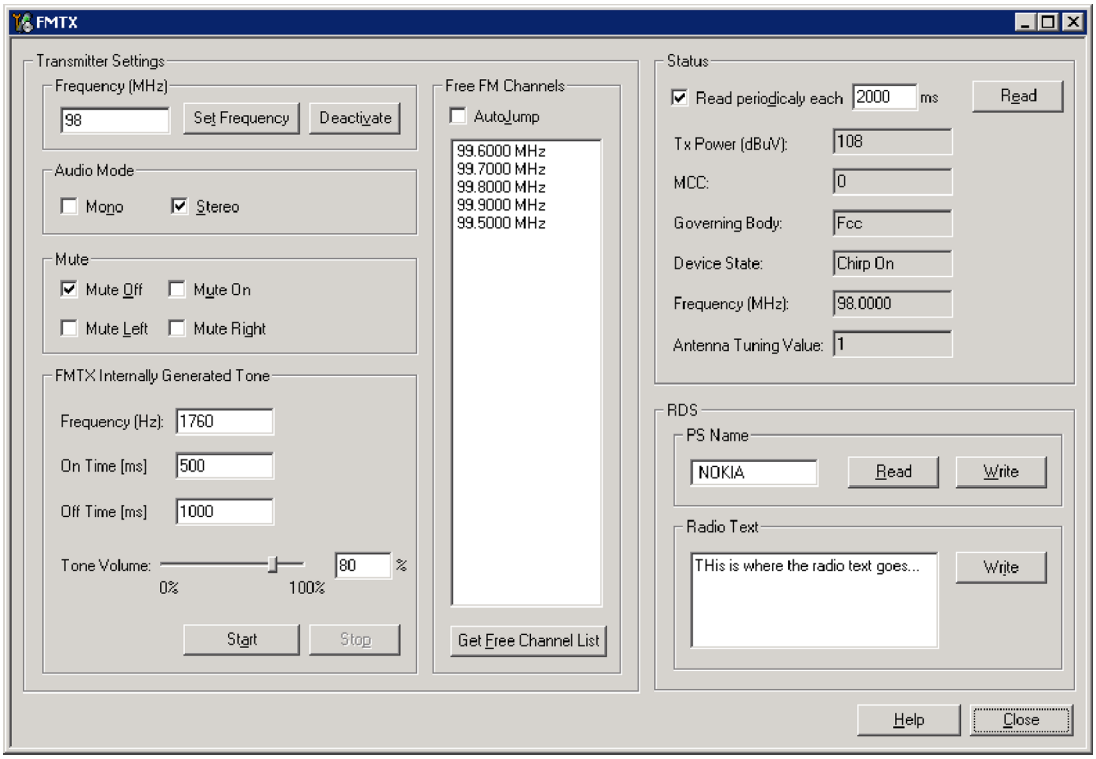

Figure 49 FMTx panel in action

Using the audio self test

The audio self test can be used to quickly determine if the left and right audio paths are intact.

The left and right audio connectivity self test process performs the following steps:

1 Measure and store silence.

2 Inject 1KHz tone (left or right) to give 75KHz deviation. Measure and store.

3 Inject same tone on both left and right analogue audio inputs. Measure and store. Compare result from (2) with result from (1). If the delta is NOT more than a specified threshold level then fail. This would indicate that the selected channel is open circuit. If an over deviation indication is detected on (2), then the audio channels must be shorted together. This is a fail condition. For (3), a returned value of zero is expected. This indicates that there is an over deviation condition which in turn indicates that the 'other' audio input channel is connected correctly.

If on (3) there is no over deviation response, then the 'other' channel must be open circuit at some point in the audio path. This is a fail condition.

The table shows the truth table for the left and right audio self test.

Table 14 Left and right audio self test truth table

LEFT	RIGHT	ASQ Condition	Comment
0	0	0	SILENCE
1	0	0	OPEN/SHORT
1	0	1	OK
1	0	2	SHORT
0	1	X	Don't Care
0	1	X	Don't Care

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LEFT	RIGHT	ASQ Condition	Comment
0	1	X	Don't Care
1	1	0	ALL OPEN/SHORT
1	1	1	OPEN
1	1	2	OK

Using the auto tune panel

The Auto Tune panel should only be used if one or more of the following components have been changed:

- The Si4713 device.
- The Inductor connected to the TX0 pin 4.
- The inline resistor connected to the TX0 pin 4 (if fitted).
- The ESD diode package connected to the TX0 pin 4 (if fitted).

This procedure follows the alignment that is done in the factory to ensure that the FMTx 2.0 solution is aligned to provide the correct Tx output power for the relevant legislations such as FCC and ETSI.

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8 — System Module and User Interface

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Introduction

Phone description

RAPIDOYAWE is the main digital baseband ASIC in the HW53. It contains functionality for both WCDMA and GSM EDGE.

AVILMA is power management ASIC having voltage regulators and audio tranceiver and BETTY is energy management ASIC having charging switch and FBUS transceiver.

Memory components are internal COMBO 1 Gb + 2Gb M3 and a card reader for MicroSD.

Function	Description	Item ref
EM ASIC	AVILMA	N2200
	BETTY	N2300
System ASIC	RAPIDOYAWE	D2800
Memory	COMBO 1Gb DDR+ 2Gb M3	D3000
Camera accelerator	OMAP-DM500	N1400
Display controller	S1D13747	D2450
Back-up battery	RTC back-up battery 311	G2200
FM-radio with RDS	BTHFMRDS2.0 discrete	N6000
Bluetooth	BTHFMRDS2.0 discrete	N6000
WLAN	WLAN Module ENW49701N	N6300
GPS	GPS5350	N6200
RF ASIC	Ahneus	N7505
GSM PA	TX FEM	N7520
WCDMA PA	850/900/1900/2100	N7540
Oscillator	VCTCXO 38.4 MHz	G7501
	Crystal 32.768 kHz	B2200
IO-expander	Basic IO-expander	N2850
SIM card reader		X2700
HS USB tranceiver	ISP15Q4A1	D3300
FM Transmitter	Si4713	N2600

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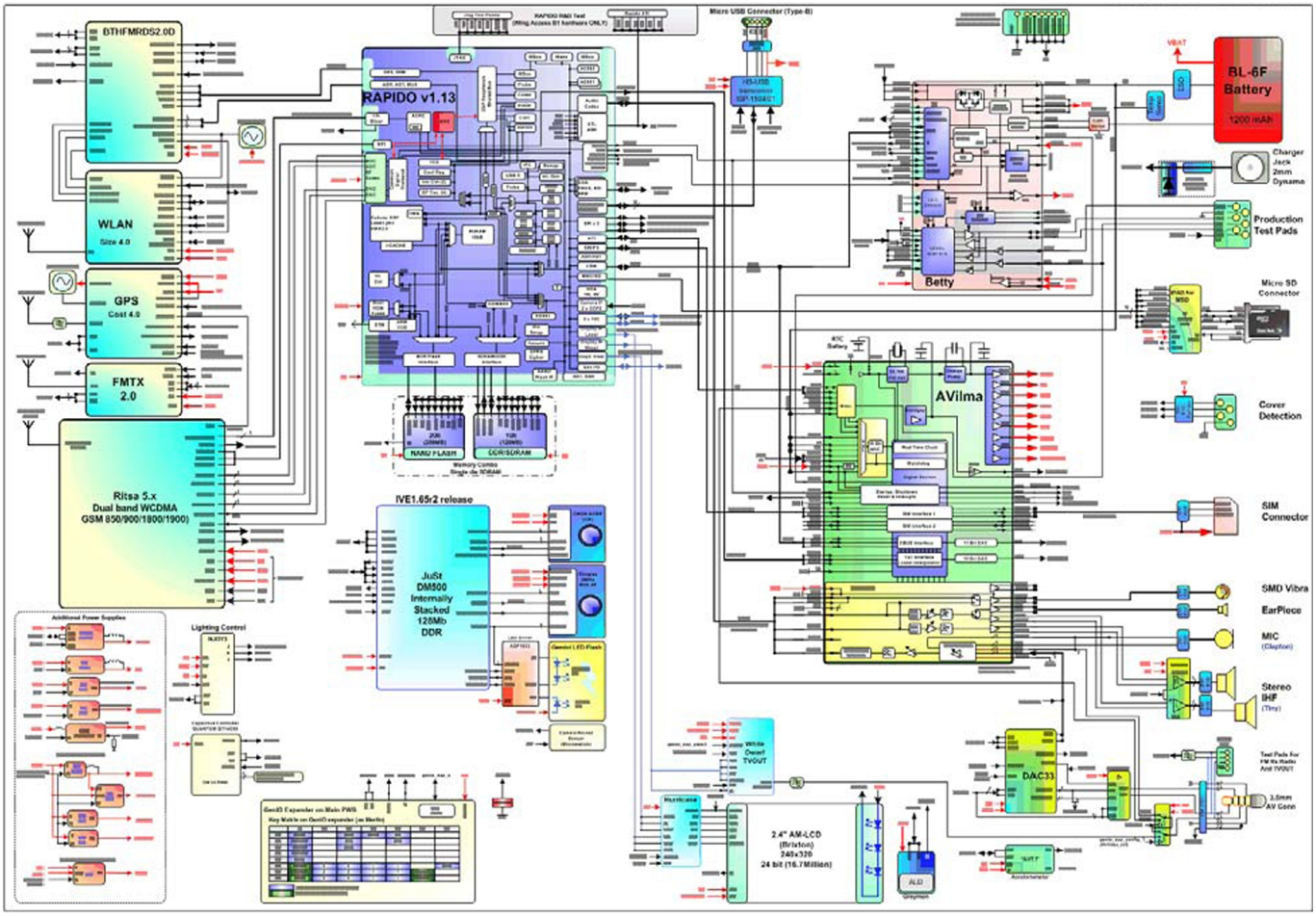
System module block diagram



Energy Management

Battery and charging

Battery

Supported battery type is BL-6F.

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Battery connector

Blade battery connector type.

- VBAT (Battery voltage)
- BSI (Battery size indication)
- GND (Battery ground)

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug).

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Backup battery

When the main battery is not attached EM ASIC (N2200) goes in backup mode using back-up battery that supplies voltage to RTC in EM ASIC (N2200).

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) BETTY and AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-6F S-pack battery is used.

Table 15 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.10	
Higher extreme voltage (fast charging)	4.20	
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.15	In call
Sw shutdown	3.30	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

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Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

Power distribution

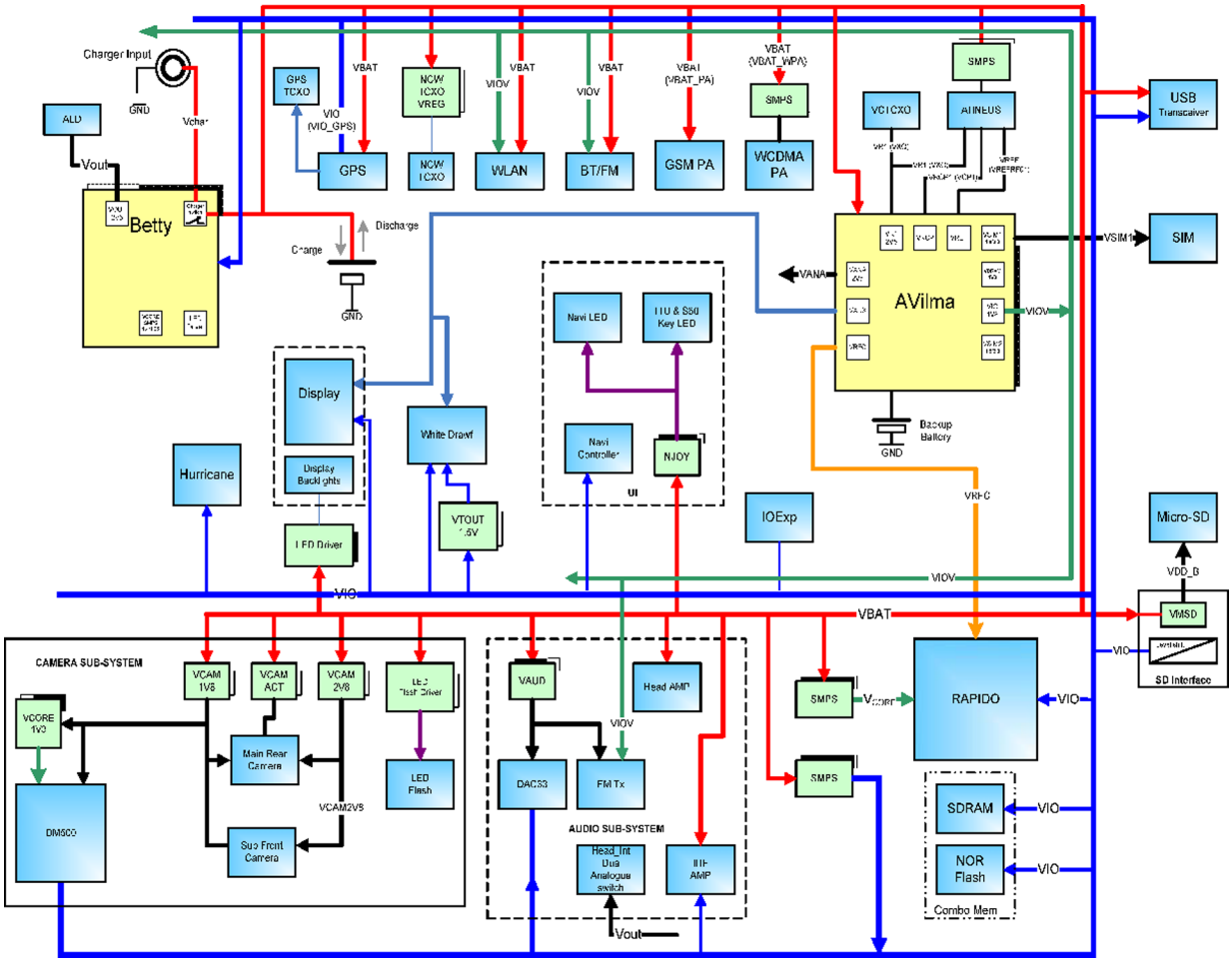

Figure 50 Power distribution

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Clocking scheme

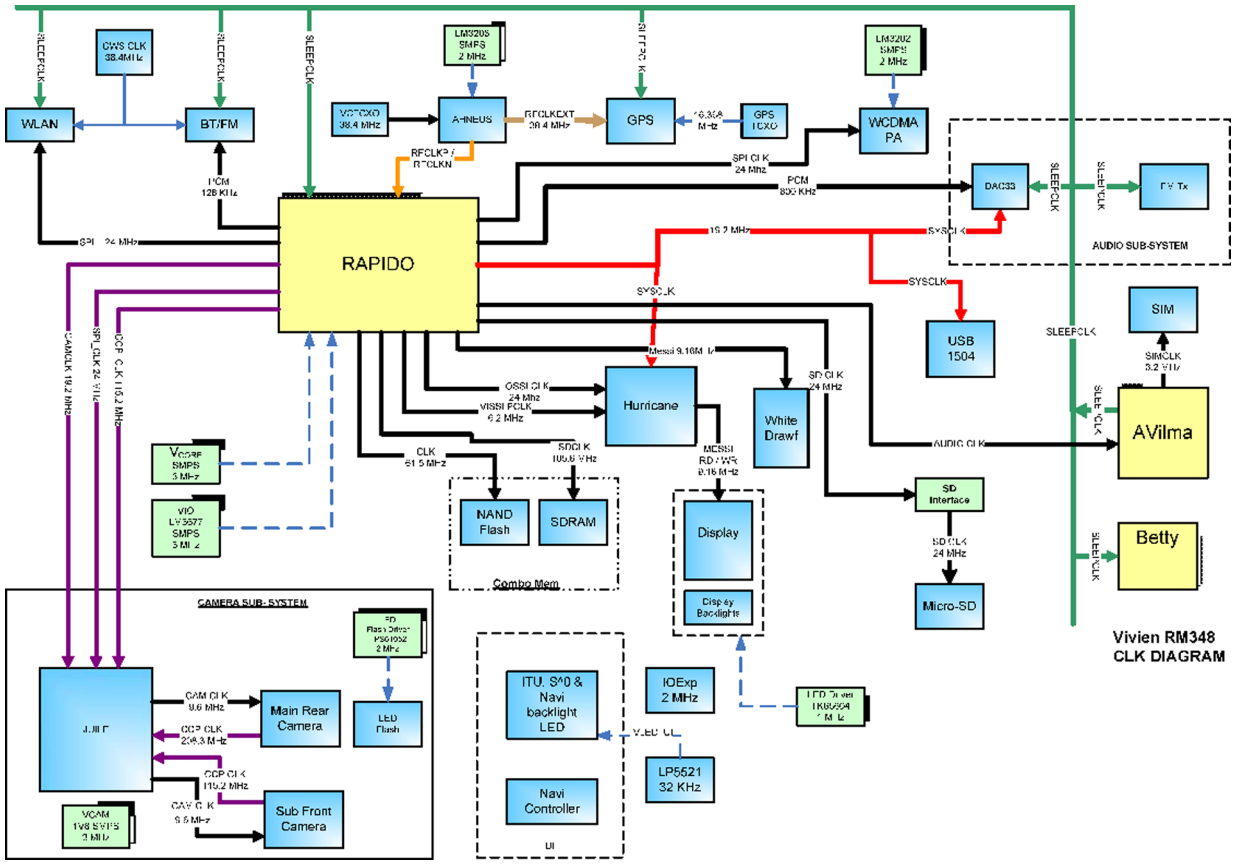

Figure 51 Clocking scheme

HW 53 engine clocks	
RFCLK	38.4 MHz
SleepClk	32.768kHz
RFCLKEXT	38.4 MHz
SYSCLK	19.2 MHz

Bluetooth and FM RDS radio module

Bluetooth and FM radio receiver are provided by the same ASIC (Broadcom BCM2048). The device supports Bluetooth operation and FM radio rececption in both European/USA and Japanese bands (the appropriate region-specific FM radio band is pre-configured in the phone software). The UART interface allows the device to communicate with the phone baseband engine using Bluetooth HCI commands. Commands to the FM radio can also be sent over the I2C interface.

When Bluetooth is switched on, the phone user interface the BT_RESETX line is toggled to reset the Bluetooth device, and commands are sent over the UART interface to configure the device. If UART communication fails (due to a hardware fault) it will not be possible to switch on Bluetooth from the phone user interface.

The device has two clock signals: CWS_CLK (38.4 MHz) and SLEEP_CLK (32.768kHz). The SLEEP_CLK is supplied all the time the phone is switched on. To maximise the phone standby time, it is only necessary to provide a CWS_CLK signal when Bluetooth activity occurs, such as sending Bluetooth data to another device, or checking periodically if there are any other Bluetooth devices attempting to communicate with it. At other

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times when the Bluetooth device is in standby mode or the FM radio is switched on it is only necessary to provide a SLEEP_CLK signal. The Bluetooth-FM ASIC is powered directly from the phone battery voltage line (VBAT). An internal regulator is enabled when Bluetooth or FM radio is switched on.

Bluetooth audio signals are sent to and from the device using a PCM interface. The Bluetooth RF signal is routed via a buried track to the Bluetooth antenna on the side of the PWB. An RF filter is needed between the Bluetooth antenna and Bluetooth ASIC to prevent interference to and from the cellular phone antenna. Phones that have both Bluetooth and WLAN use a shared antenna, as both services occupy the 2.4GHz ISM frequency band. The co-existence signalling interface between Bluetooth and WLAN ASICs controls the RF activity in the shared frequency band.

The audio signal from the FM radio is routed via the phone Audio ASIC to the phone headset or loudspeaker. The external wired headset is also used as an Antenna for the FM radio. The FM radio receiver RF signal is routed from the ASIC via a buried track to an impedance matching circuit placed near the headset connector.

The following block diagram shows how Bluetooth-FM is connected to the host engine.

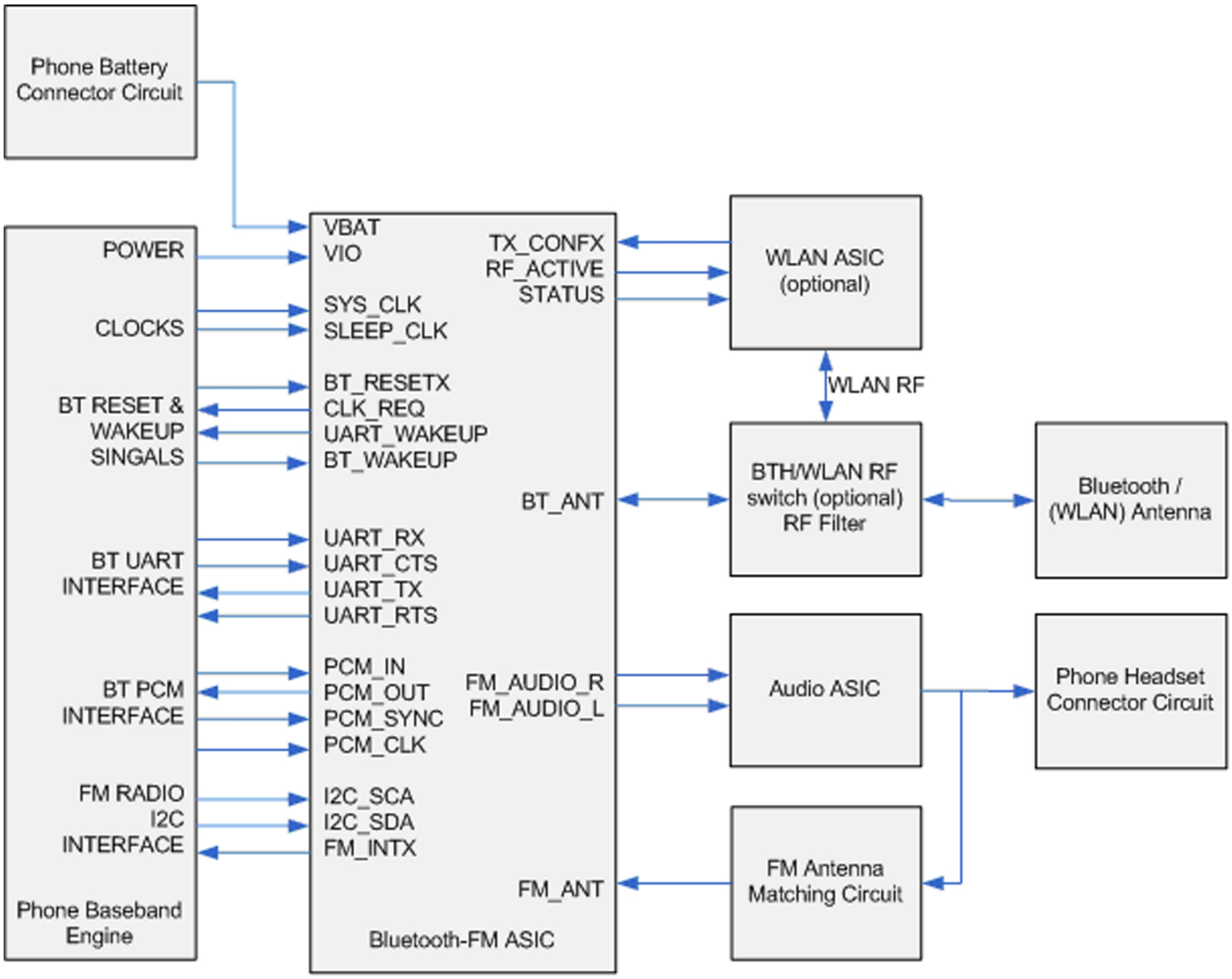

Figure 52 Bluetooth & FM radio block diagram

GPS module

HW 53 supports GPSCost4.0 release. GPS module is connected to cellular engine via I2C interface and GenIO control signals. GPS clock configuration includes dedicated GPS TCXO and reference clock from Ahneus.

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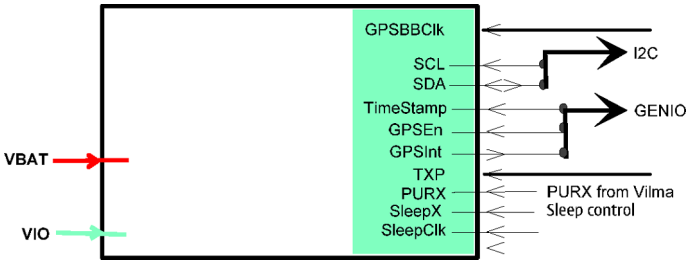

Figure 53 GPS module

WLAN module

WLAN module HW53 supports WLANSize4.0 release. WLAN module is configured as Cellular engine SPI slave. WLAN and Bluetooth co-existence is supported via BTH-WLAN interface. WLANSize4.0 have reference clock of external oscillator 38.4MHz and it is shared with BTHFMRDS2.0.

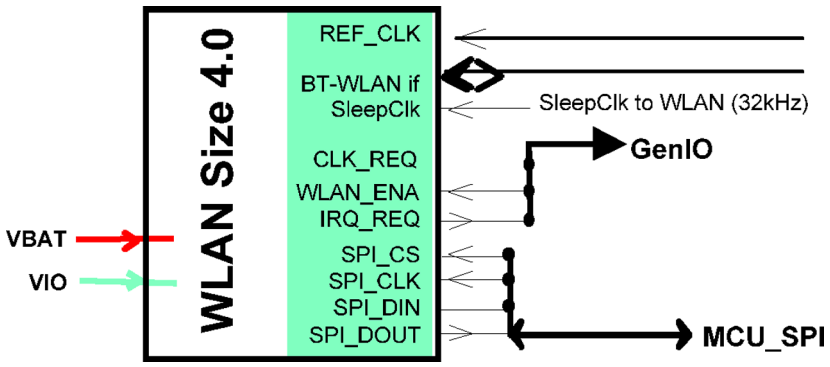

Figure 54 WLAN module

FM transmitter module

The FM transmitter module Si4713 is controlled by I2C from RAPIDO with left and right analog audio input from the DAC33.

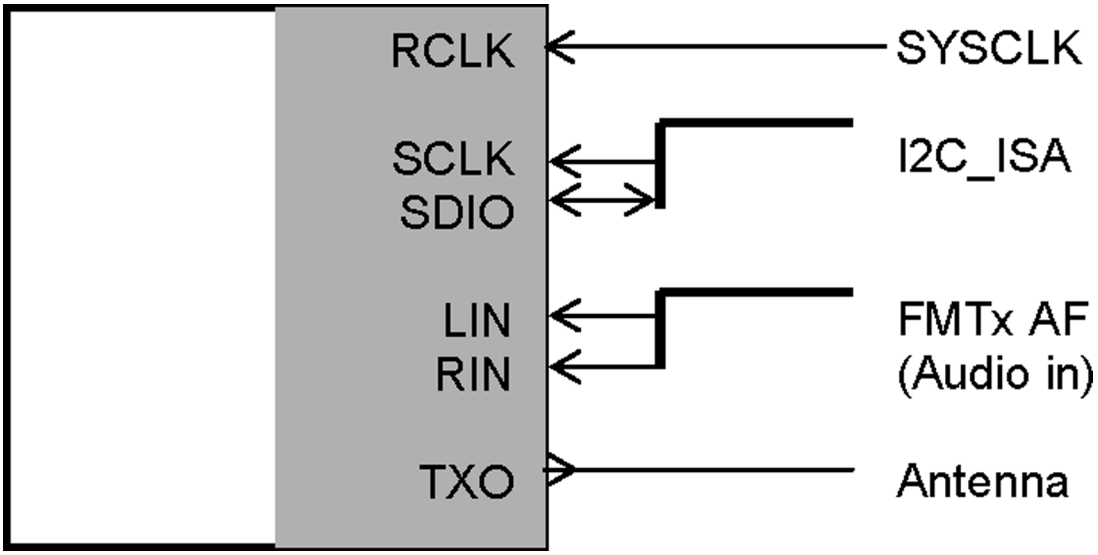

Figure 55 FM transmitter

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TV out

In this phone the 3.5mm AV connector has a double function - depending of the mode the phone is put in the AV connector will operate as a normal galvanic connector for headsets etc or as TV output (that can be connector to a external TV.

In TV mode the cable CA-75U is used to connect the AV connector to the TV (RCA connectors). Both NTSC and PAL standards are supported by the TV out function.

Depending on the position of the switch (N2003), compressed video signal is feed to pin 3 or audio input from external microphone is feed to the phone.

Note: Only use an approved cable for connecting to the AV connector (CA-75U).

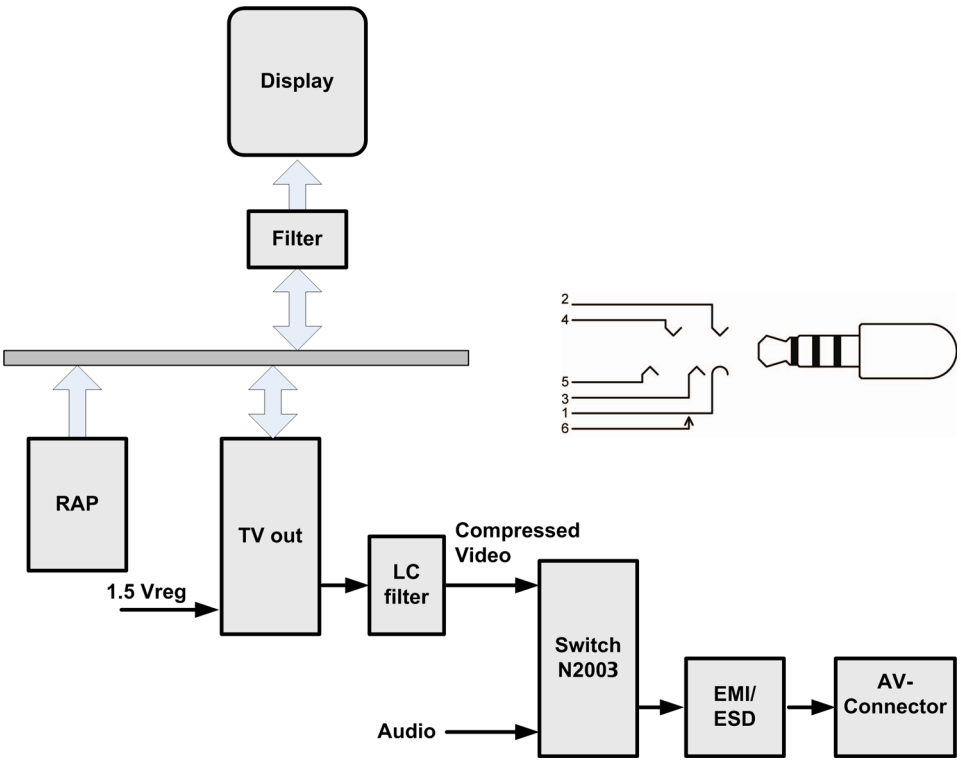

Figure 56 TV out block diagram

Table 16 AV connector pins

Pin	Signal name	Direction	Description
1, 2	HS_ GND	-	Ground)
3	HS_MIC/ HS_COMP_VIDEO	Input/Output	Microphone input Video output depending on switch N2003
4	HS_EAR_R	Output	Audio out
5	HS_EAR_L	Output	Audio out
6	PLUG_DET	Input	Plug detection

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High-speed USB

High-speed USB

The device can transmit and receive USB data at high-speed (480 Mbit/s), full-speed (12 Mbit/s) and low-speed (1.5Mbit/s). The external interface is the micro-B connector X3300. The interface between D3300 USB transceiver and micro-B receptacle is the standard USB interface specified in the Universal Serial Bus specification Rev. 2.0. The USB transfers signal and power over four-wire interface, which carries differential data, Vbus and GND. Signalling occurs over differential data line D+ and D-. The clock is transmitted encoded along with the differential data. ESD protection is done with USB ASIP Z3300. VBUS (+5V) is provided by the host device. The circuit is protected from an overvoltage condition by transistor pair V3300 and reference zenner diode V3301.

CBUS interface

CBUS is a "main" system control bus in BB5. RAPIDO controls the functionality of EM ASICs AVilma (N2200) and Betty (N2300) with CBUS.

CBUS is a four-wire half-duplex master-slave interface. In HW53 CBUS clock frequency is 4.39 MHz.

FBUS interface

FBUS is a 2-wire serial communication bus between HW53 engine and service SW.

ECI interface

The ECI (Enhancement Control Interface) is a point-to-point, bi-directional, single line serial bus.

The purpose of the ECI is to identify and authenticate the accessory, and to act as a data bus (intended for control purposes) between the phone and the accessory .

Charger interface

Charging control and charge switch are situated in EM ASIC (N2300).

If the temperature rises too high and the thermal protection is activated, EM ASIC (N2300) goes to protection mode.

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAPIDO and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

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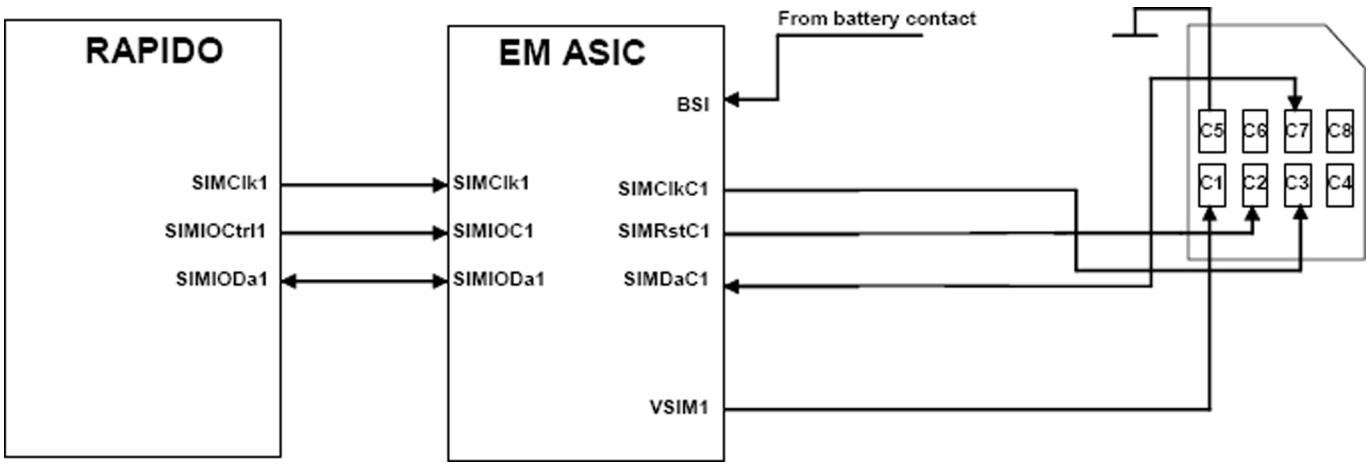

Figure 57 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM IF.

The EM ASIC SIM1 interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

MicroSD card interface

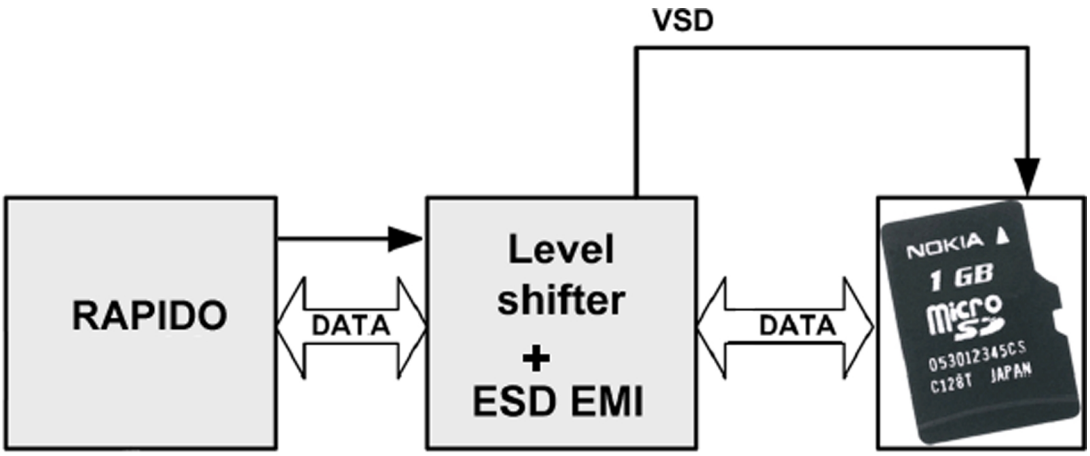

Figure 58 MicroSD card interface

The MicroSD card is connected to the engine by an external level shifter with an ESD protection filter. Supplied voltages:

- VSD: 2.85 V (from level shifter)
- VIO: 1.8 V (from VIO SMPS)

Hot swap is supported, which means that the card may be plugged in/out at any time, without removing the battery.

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Camera concept

The camera is supported by DM500 (N1400) Camera accelerator, which is used for image and video processing. DM-500 uses 128Mbit stacked DDR SDRAM. The camera module includes 5MPix main camera, CIF+ secondary camera, Flash LED and ADP1653 LED driver which are connected to DM500.

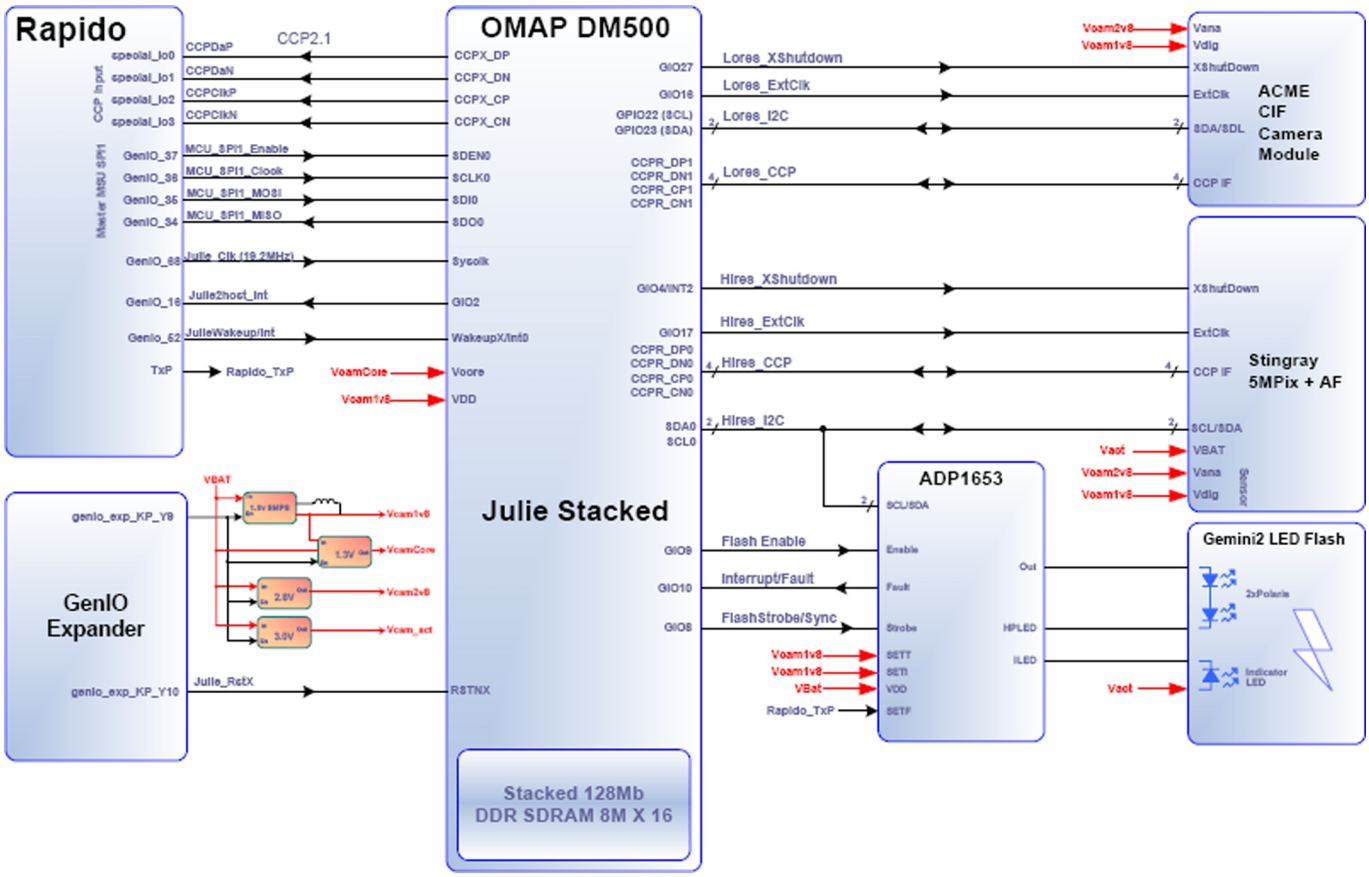

Figure 59 Camera block diagram

User Interface

User interface

The UI module contains the following main features:

- ITU keypad and five-way cursor control and dedicated multimedia key implemented on a standard cross-point matrix
- Finger position sensing beneath the five-way cursor control for the implementation of scrolling features in the UI
- Two different lighting zones for the UI features described below

The cross-point matrix and LEDs are connected to the handset engine using the I/O expander described below, and the finger position sensing controller is connected via an I2C bus.

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	SF	Y0	Y1	Y2	Y3	Y4	Y5
X0	Up		L-SOFT	R-SOFT	END		
X1	Down		APPL		SEND		
X2	Left		CLEAR				
X3	Right						
X4	Select						
X5	**SLIDE LOCK**	1	5	9	*		**MEDIA**
X6	**VOL DOWN**	6	7	0	2	**SHUTTER (H)**	
X7	**VOL UP**	8	#	3	4	**SHUTTER (F)**	

KEY

ITU
NAVI
S60 and MM key
Side Keys

Figure 60 Key matrix

The capacitive sensors function by sensing changes in the charge coupled from one electrode to another when the user's finger is placed close to the electrodes patterns in terms of the five-way cursor control.

Due to the construction of the module (keymat attached with proper pressure by unique jig) service requires the unique jig to be replaced.

I/O expander and keyboard

HW53 supports I/O Expander. I/O expander is connected to Rapido via I2C bus and one GenIO is used as an interrupt pin. Keyboard matrix 8x6 is connected to I/O expander. In addition to keyboard matrix the I/O expander has general purpose IO:s.

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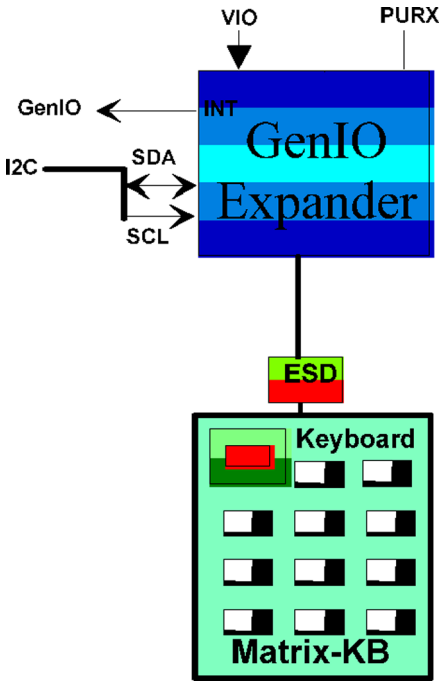

Figure 61 I/O expander and keyboard matrix

Display module

HW53 supports S1D13747 display controller (D2450). S1D13747 controlling is done via LOSSI IF and data is transferred via VISSI 12 bit IF. The display is connected to display controller shared MESSI 8 bit bus.

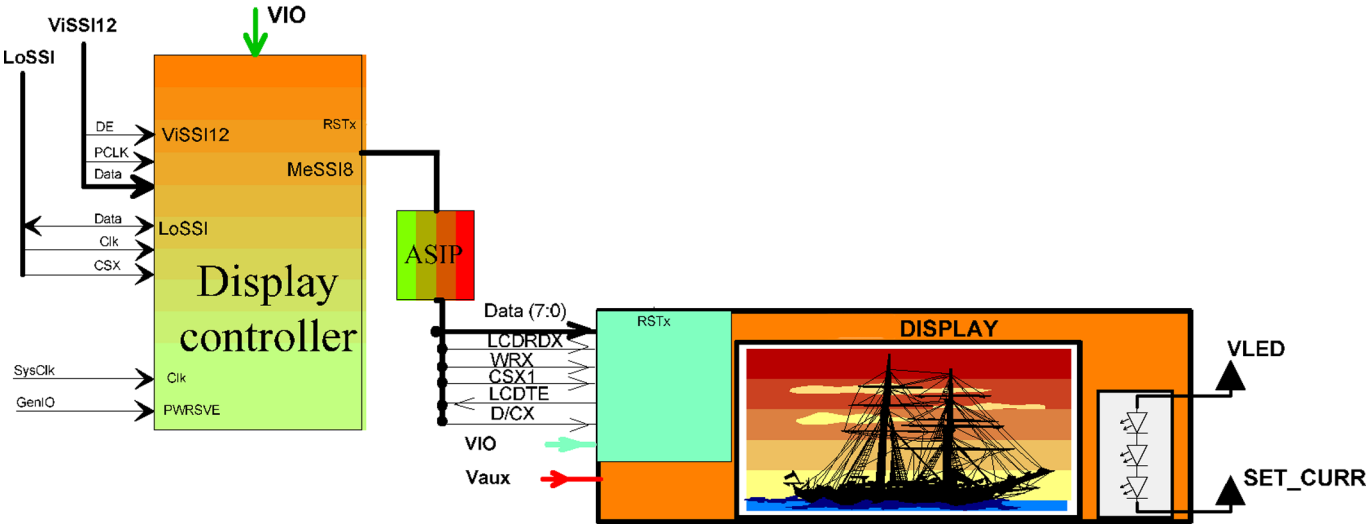

Figure 62 Display module

Backlight and illumination

The LED driver LP5521 (N2499) has three different outputs to drive LEDs. Navi LED is controlled by the separate output from ITU/S60 LEDs to enable breathing during sleep mode.

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The display backlighting is sourced from the constant current regulator N2301 and enabled from the PWM 300 output from Betty. The current is set by the 33R resistor to ground.

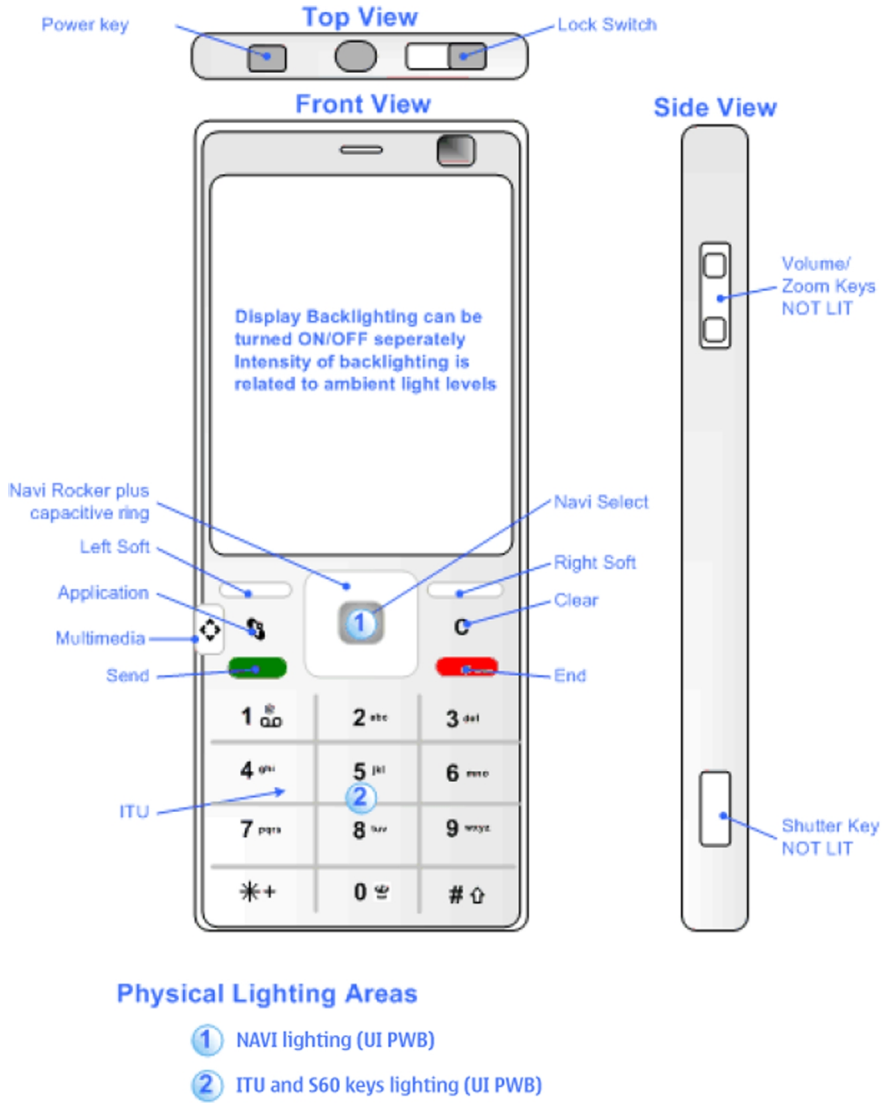

Figure 63 Lighting areas

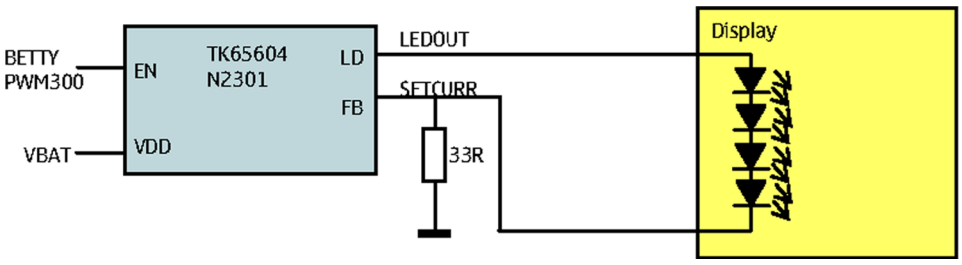

Figure 64 Display and key backlighting control

Ambient Light Sensor

In order to optimise user interface legibility, the display and UI illumination brightness is controlled by the handset according to the ambient lighting conditions. The ambient light level is measured by the handset using the Ambient Light Sensor/Detector N6502 which communicates to the engine via the I2C interface:

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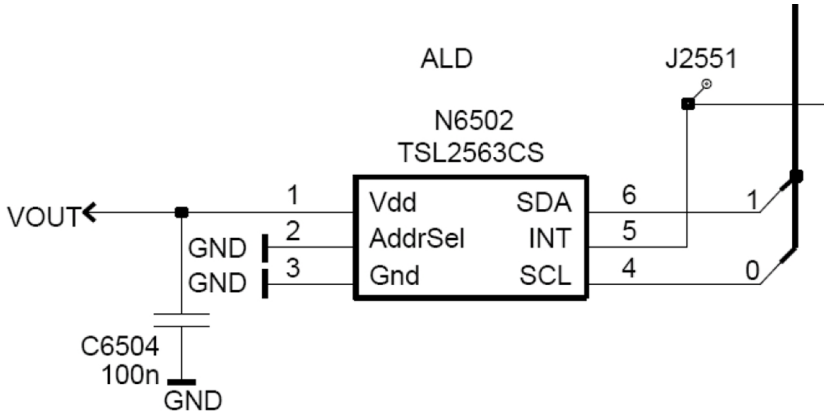

Figure 65 Ambient Light Sensor

The sensor light aperture is on the front of the handset next to the front camera aperture.

ASICs

RAPIDOYAWE

RAPIDOYAWE ASIC (D2800) is a die-stacked Processor (RAPIDO) with 3G HDSPA logic (YAWE). RAM memory is integrated into RAPIDO.

EM ASIC BETTY N2300

The EM ASIC (N2300) includes the following functional blocks:

- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- LED control for display backlighting
- Digital interface (CBUS)

EM ASIC VILMA N2200

The EM ASIC (N2200) includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

EMC ASIP (Appcation Specified Integrated Passive) have been integrated inside the ASIC. It includes biasing passives for microphone , EMC filter for SIM, microphones etc.

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Device Memories

Combo memory

The memory of the device consists of stacked DDR SDRAM and MuxedMassMemory (M3). Combo memory DDR/ M3 memory has 1 Gb DDR + 2Gb M3.

Audio Concept

Audio HW architecture

The functional core of the audio hardware is built around three ASICs: RAPIDOYAWE engine ASIC, mixed signal ASIC Avilma and D/A converter DAC33.

DAC33 converts digital audio signal to analog and is routed to the FM Transmitter and amplifier TPA6130 which provides an interface for the transducers and the accessory connector.

Integrated handsfree stereo speakers are driven by a D-class audio amplifier TPA2012D2.

There are two audio transducers:

- 7x11 mm dynamic earpiece
- Two 8X12 mm dynamic speakers

Avilma provides an output for the dynamic vibra component. All galvanic audio accessories are connected to the AV accessory connector.

A Bluetooth audio and FM radio module, which is connected to the RAPIDOYAWE supports Bluetooth audio and FM radio functionality.

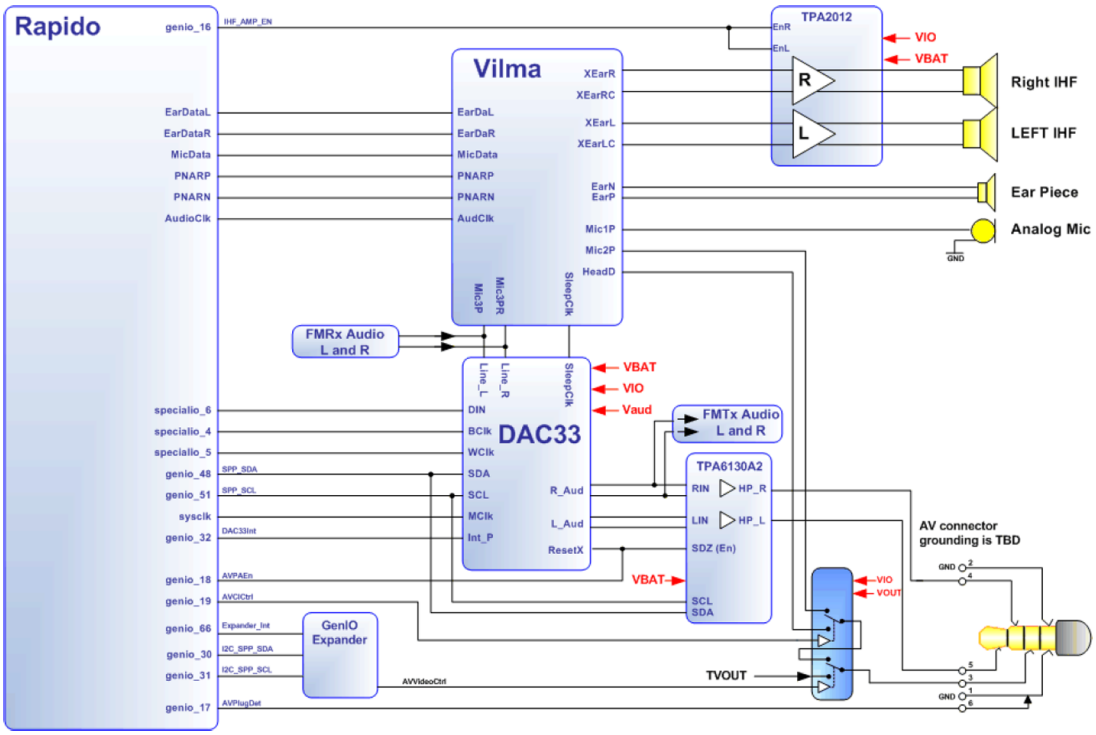

Figure 66 Audio system block

Internal microphone

The internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

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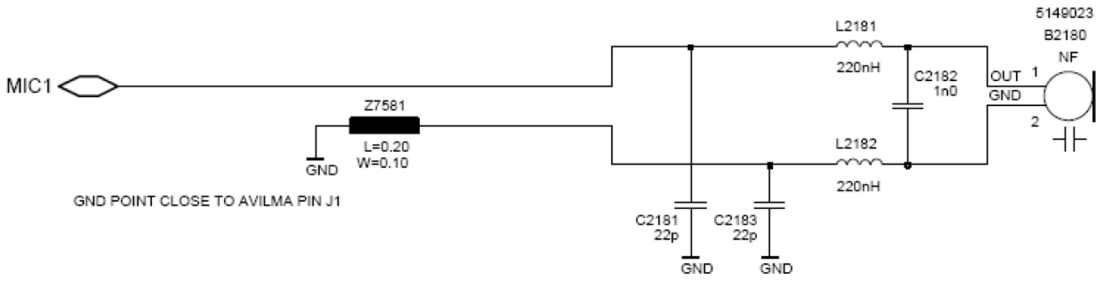

Figure 67 Internal microphone

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic 7x11 mm earpiece capsule is connected to Avilma ASIC's differential output EarP and EarN.

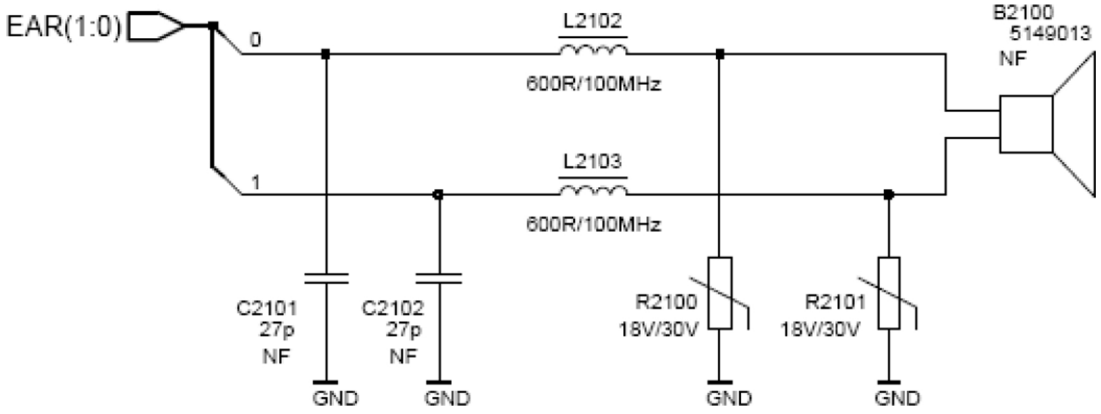

Figure 68 Internal earpiece circuitry

Internal speakers

Internal speakers are used for Internal HandsFree (IHF) call mode, video call, ringing tones, FM radio and music listening. Two dynamic 8x12mm speakers are connected to Avilma ASIC's outputs XearR/XearL via stereo D-class IHF amplifier TPA2012D2. The amplifier has 24 dB fixed gain and it is put to shutdown mode when not in use.

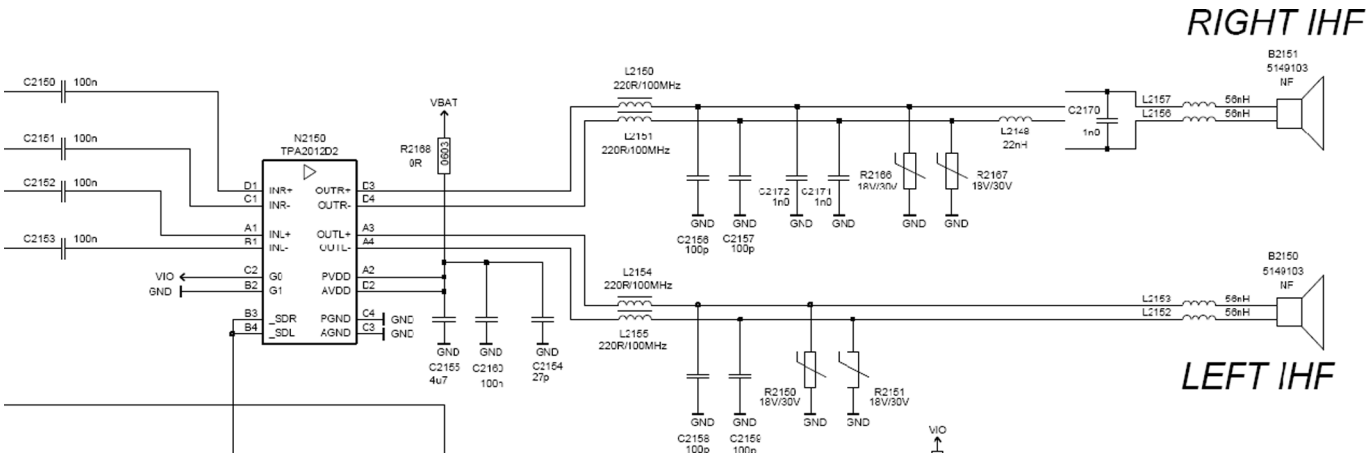

Figure 69 Internal speakers

Vibra circuitry

Vibra is used for the vibra alarm function.

The vibra motor is connected to the Avilma ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.

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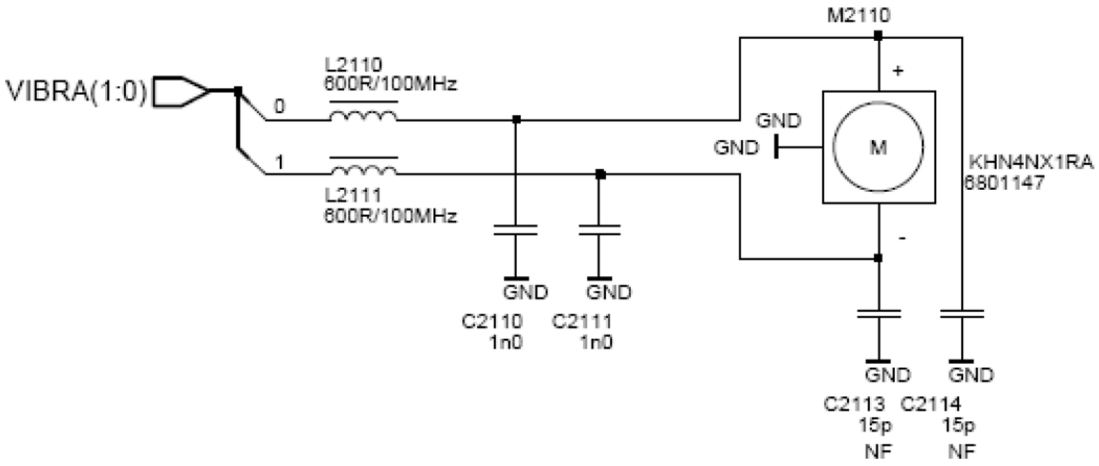

Figure 70 Vibra circuitry

Accessory AV connector

The features that are supported by HW53 accessory interface are the following:

- Audio output (stereo headset/headphones having the impedance >16ohm)
- Audio input (mono microphone from headset)
- Control data (ECI)

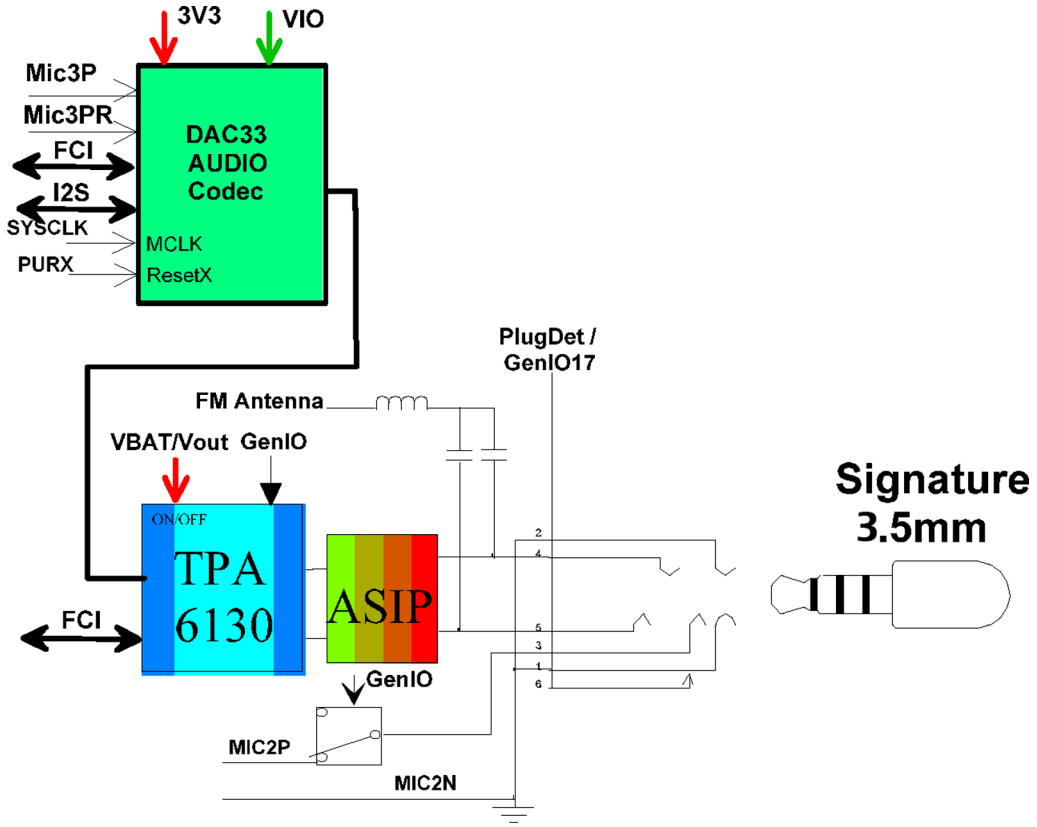

Figure 71 Accessory (AV) connector with DAC33 and TPA6130 audio enhancements

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Baseband Technical Specifications

External interfaces

Name of connection	Connector reference
HS USB	X3300
MicroSD card	X3200
Battery connector	X2070
SIM card reader	X2700
Accessory (AV) connector	N/A
Charger	X2000

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
3	VSIM	Out	EM ASIC N2200	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
2	SIMRST	Out	EM ASIC N2200	SIM1Rst	Reset signal to SIM card
1	SIMCLK	Out	EM ASIC N2200	SIM1ClkC	Clock signal to SIM card
7	GND	-	GND		Ground
5	SIMDATA	In/Out	EM ASIC N2200	SIM1DaC	Data input / output

Charger connector and charging interface connections & electrical characteristics

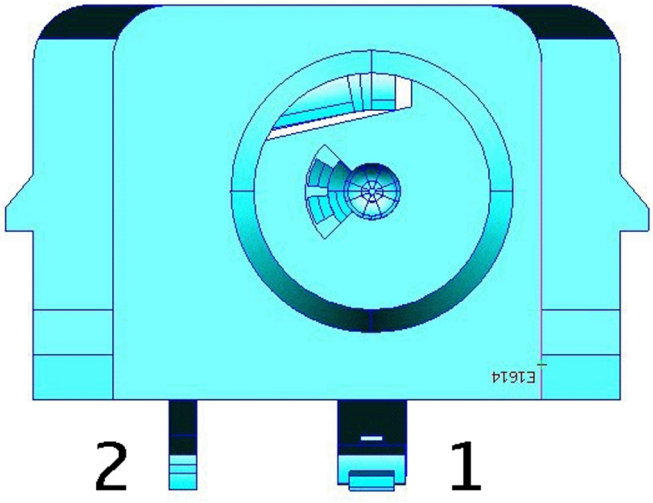

Figure 72 Charger connector

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Table 17 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	N2300	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 18 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	9	V	Center pin
Vchar	I Charge		0.85	A	Center pin
Charge GND			0.85	A	

Internal interfaces

Name of connection	Component reference
DALS	N6502
Earpiece	B2100
Microphone	B2180
IHF speakers	B2151 / B2150
Main camera socket	X1450
Sub-camera	N1450
Main display connector	X2450
Vibra	M2110

Back-up battery interface electrical characteristics

Table 19 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.5	2.7	V

RF Technical Description

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

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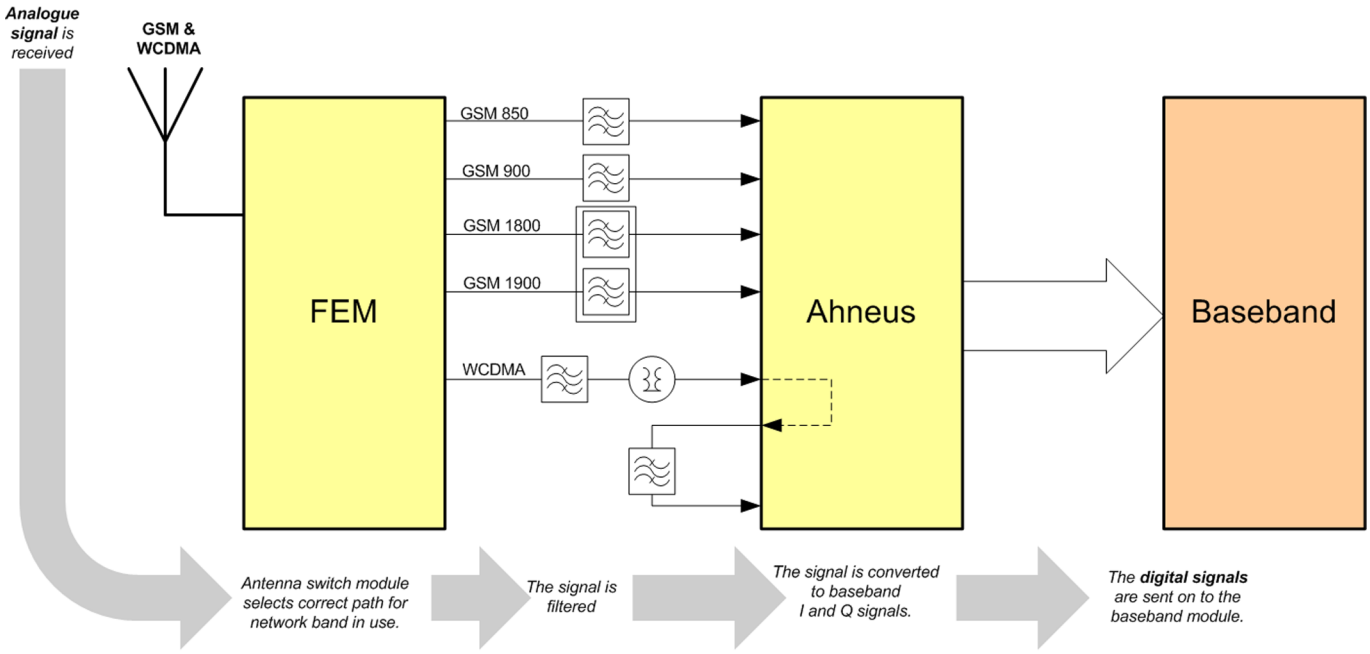
Signals with different frequencies take different paths, therefore being handled by different components. The principle of GSM and WCDMA is the same.

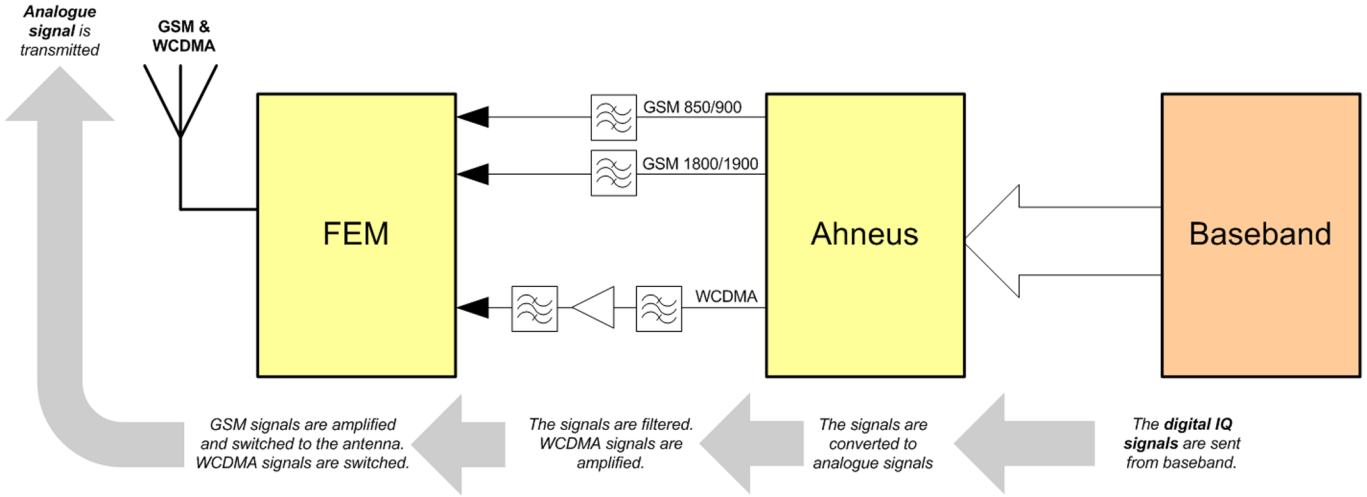


Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwith of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.

Even though the GSM and WCDMA signals are sent via different components, the principles of the transmission is the same.



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Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

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EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

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GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

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GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

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WCDMA 2100 Rx frequencies

Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX
10562	2112.4	4224.8	10625	2125	4250	10688	2137.6	4275.2	10751	2150.2	4300.4	10814	2162.8	4325.6
10563	2112.6	4225.2	10626	2125.2	4250.4	10689	2137.8	4275.6	10752	2150.4	4300.8	10815	2163	4326
10564	2112.8	4225.6	10627	2125.4	4250.8	10690	2138	4276	10753	2150.6	4301.2	10816	2163.2	4326.4
10565	2113	4226	10628	2125.6	4251.2	10691	2138.2	4276.4	10754	2150.8	4301.6	10817	2163.4	4326.8
10566	2113.2	4226.4	10629	2125.8	4251.6	10692	2138.4	4276.8	10755	2151	4302	10818	2163.6	4327.2
10567	2113.4	4226.8	10630	2126	4252	10693	2138.6	4277.2	10756	2151.2	4302.4	10819	2163.8	4327.6
10568	2113.6	4227.2	10631	2126.2	4252.4	10694	2138.8	4277.6	10757	2151.4	4302.8	10820	2164	4328
10569	2113.8	4227.6	10632	2126.4	4252.8	10695	2139	4278	10758	2151.6	4303.2	10821	2164.2	4328.4
10570	2114	4228	10633	2126.6	4253.2	10696	2139.2	4278.4	10759	2151.8	4303.6	10822	2164.4	4328.8
10571	2114.2	4228.4	10634	2126.8	4253.6	10697	2139.4	4278.8	10760	2152	4304	10823	2164.6	4329.2
10572	2114.4	4228.8	10635	2127	4254	10698	2139.6	4279.2	10761	2152.2	4304.4	10824	2164.8	4329.6
10573	2114.6	4229.2	10636	2127.2	4254.4	10699	2139.8	4279.6	10762	2152.4	4304.8	10825	2165	4330
10574	2114.8	4229.6	10637	2127.4	4254.8	10700	2140	4280	10763	2152.6	4305.2	10826	2165.2	4330.4
10575	2115	4230	10638	2127.6	4255.2	10701	2140.2	4280.4	10764	2152.8	4305.6	10827	2165.4	4330.8
10576	2115.2	4230.4	10639	2127.8	4255.6	10702	2140.4	4280.8	10765	2153	4306	10828	2165.6	4331.2
10577	2115.4	4230.8	10640	2128	4256	10703	2140.6	4281.2	10766	2153.2	4306.4	10829	2165.8	4331.6
10578	2115.6	4231.2	10641	2128.2	4256.4	10704	2140.8	4281.6	10767	2153.4	4306.8	10830	2166	4332
10579	2115.8	4231.6	10642	2128.4	4256.8	10705	2141	4282	10768	2153.6	4307.2	10831	2166.2	4332.4
10580	2116	4232	10643	2128.6	4257.2	10706	2141.2	4282.4	10769	2153.8	4307.6	10832	2166.4	4332.8
10581	2116.2	4232.4	10644	2128.8	4257.6	10707	2141.4	4282.8	10770	2154	4308	10833	2166.6	4333.2
10582	2116.4	4232.8	10645	2129	4258	10708	2141.6	4283.2	10771	2154.2	4308.4	10834	2166.8	4333.6
10583	2116.6	4233.2	10646	2129.2	4258.4	10709	2141.8	4283.6	10772	2154.4	4308.8	10835	2167	4334
10584	2116.8	4233.6	10647	2129.4	4258.8	10710	2142	4284	10773	2154.6	4309.2	10836	2167.2	4334.4
10585	2117	4234	10648	2129.6	4259.2	10711	2142.2	4284.4	10774	2154.8	4309.6	10837	2167.4	4334.8
10586	2117.2	4234.4	10649	2129.8	4259.6	10712	2142.4	4284.8	10775	2155	4310	10838	2167.6	4335.2
10587	2117.4	4234.8	10650	2130	4260	10713	2142.6	4285.2	10776	2155.2	4310.4			
10588	2117.6	4235.2	10651	2130.2	4260.4	10714	2142.8	4285.6	10777	2155.4	4310.8			
10589	2117.8	4235.6	10652	2130.4	4260.8	10715	2143	4286	10778	2155.6	4311.2			
10590	2118	4236	10653	2130.6	4261.2	10716	2143.2	4286.4	10779	2155.8	4311.6			
10591	2118.2	4236.4	10654	2130.8	4261.6	10717	2143.4	4286.8	10780	2156	4312			
10592	2118.4	4236.8	10655	2131	4262	10718	2143.6	4287.2	10781	2156.2	4312.4			
10593	2118.6	4237.2	10656	2131.2	4262.4	10719	2143.8	4287.6	10782	2156.4	4312.8			
10594	2118.8	4237.6	10657	2131.4	4262.8	10720	2144	4288	10783	2156.6	4313.2			
10595	2119	4238	10658	2131.6	4263.2	10721	2144.2	4288.4	10784	2156.8	4313.6			
10596	2119.2	4238.4	10659	2131.8	4263.6	10722	2144.4	4288.8	10785	2157	4314			
10597	2119.4	4238.8	10660	2132	4264	10723	2144.6	4289.2	10786	2157.2	4314.4			
10598	2119.6	4239.2	10661	2132.2	4264.4	10724	2144.8	4289.6	10787	2157.4	4314.8			
10599	2119.8	4239.6	10662	2132.4	4264.8	10725	2145	4290	10788	2157.6	4315.2			
10600	2120	4240	10663	2132.6	4265.2	10726	2145.2	4290.4	10789	2157.8	4315.6			
10601	2120.2	4240.4	10664	2132.8	4265.6	10727	2145.4	4290.8	10790	2158	4316			
10602	2120.4	4240.8	10665	2133	4266	10728	2145.6	4291.2	10791	2158.2	4316.4			
10603	2120.6	4241.2	10666	2133.2	4266.4	10729	2145.8	4291.6	10792	2158.4	4316.8			
10604	2120.8	4241.6	10667	2133.4	4266.8	10730	2146	4292	10793	2158.6	4317.2			
10605	2121	4242	10668	2133.6	4267.2	10731	2146.2	4292.4	10794	2158.8	4317.6			
10606	2121.2	4242.4	10669	2133.8	4267.6	10732	2146.4	4292.8	10795	2159	4318			
10607	2121.4	4242.8	10670	2134	4268	10733	2146.6	4293.2	10796	2159.2	4318.4			
10608	2121.6	4243.2	10671	2134.2	4268.4	10734	2146.8	4293.6	10797	2159.4	4318.8			
10609	2121.8	4243.6	10672	2134.4	4268.8	10735	2147	4294	10798	2159.6	4319.2			
10610	2122	4244	10673	2134.6	4269.2	10736	2147.2	4294.4	10799	2159.8	4319.6			
10611	2122.2	4244.4	10674	2134.8	4269.6	10737	2147.4	4294.8	10800	2160	4320			
10612	2122.4	4244.8	10675	2135	4270	10738	2147.6	4295.2	10801	2160.2	4320.4			
10613	2122.6	4245.2	10676	2135.2	4270.4	10739	2147.8	4295.6	10802	2160.4	4320.8			
10614	2122.8	4245.6	10677	2135.4	4270.8	10740	2148	4296	10803	2160.6	4321.2			
10615	2123	4246	10678	2135.6	4271.2	10741	2148.2	4296.4	10804	2160.8	4321.6			
10616	2123.2	4246.4	10679	2135.8	4271.6	10742	2148.4	4296.8	10805	2161	4322			
10617	2123.4	4246.8	10680	2136	4272	10743	2148.6	4297.2	10806	2161.2	4322.4			
10618	2123.6	4247.2	10681	2136.2	4272.4	10744	2148.8	4297.6	10807	2161.4	4322.8			
10619	2123.8	4247.6	10682	2136.4	4272.8	10745	2149	4298	10808	2161.6	4323.2			
10620	2124	4248	10683	2136.6	4273.2	10746	2149.2	4298.4	10809	2161.8	4323.6			
10621	2124.2	4248.4	10684	2136.8	4273.6	10747	2149.4	4298.8	10810	2162	4324			
10622	2124.4	4248.8	10685	2137	4274	10748	2149.6	4299.2	10811	2162.2	4324.4			
10623	2124.6	4249.2	10686	2137.2	4274.4	10749	2149.8	4299.6	10812	2162.4	4324.8			
10624	2124.8	4249.6	10687	2137.4	4274.8	10750	2150	4300	10813	2162.6	4325.2			

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WCDMA 2100 Tx frequencies

Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx
9612	1922.4	3844.8	9671	1934.2	3868.4	9730	1946	3892	9789	1957.8	3915.6	9848	1969.6	3939.2
9613	1922.6	3845.2	9672	1934.4	3868.8	9731	1946.2	3892.4	9790	1958	3916	9849	1969.8	3939.6
9614	1922.8	3845.6	9673	1934.6	3869.2	9732	1946.4	3892.8	9791	1958.2	3916.4	9850	1970	3940
9615	1923	3846	9674	1934.8	3869.6	9733	1946.6	3893.2	9792	1958.4	3916.8	9851	1970.2	3940.4
9616	1923.2	3846.4	9675	1935	3870	9734	1946.8	3893.6	9793	1958.6	3917.2	9852	1970.4	3940.8
9617	1923.4	3846.8	9676	1935.2	3870.4	9735	1947	3894	9794	1958.8	3917.6	9853	1970.6	3941.2
9618	1923.6	3847.2	9677	1935.4	3870.8	9736	1947.2	3894.4	9795	1959	3918	9854	1970.8	3941.6
9619	1923.8	3847.6	9678	1935.6	3871.2	9737	1947.4	3894.8	9796	1959.2	3918.4	9855	1971	3942
9620	1924	3848	9679	1935.8	3871.6	9738	1947.6	3895.2	9797	1959.4	3918.8	9856	1971.2	3942.4
9621	1924.2	3848.4	9680	1936	3872	9739	1947.8	3895.6	9798	1959.6	3919.2	9857	1971.4	3942.8
9622	1924.4	3848.8	9681	1936.2	3872.4	9740	1948	3896	9799	1959.8	3919.6	9858	1971.6	3943.2
9623	1924.6	3849.2	9682	1936.4	3872.8	9741	1948.2	3896.4	9800	1960	3920	9859	1971.8	3943.6
9624	1924.8	3849.6	9683	1936.6	3873.2	9742	1948.4	3896.8	9801	1960.2	3920.4	9860	1972	3944
9625	1925	3850	9684	1936.8	3873.6	9743	1948.6	3897.2	9802	1960.4	3920.8	9861	1972.2	3944.4
9626	1925.2	3850.4	9685	1937	3874	9744	1948.8	3897.6	9803	1960.6	3921.2	9862	1972.4	3944.8
9627	1925.4	3850.8	9686	1937.2	3874.4	9745	1949	3898	9804	1960.8	3921.6	9863	1972.6	3945.2
9628	1925.6	3851.2	9687	1937.4	3874.8	9746	1949.2	3898.4	9805	1961	3922	9864	1972.8	3945.6
9629	1925.8	3851.6	9688	1937.6	3875.2	9747	1949.4	3898.8	9806	1961.2	3922.4	9865	1973	3946
9630	1926	3852	9689	1937.8	3875.6	9748	1949.6	3899.2	9807	1961.4	3922.8	9866	1973.2	3946.4
9631	1926.2	3852.4	9690	1938	3876	9749	1949.8	3899.6	9808	1961.6	3923.2	9867	1973.4	3946.8
9632	1926.4	3852.8	9691	1938.2	3876.4	9750	1950	3900	9809	1961.8	3923.6	9868	1973.6	3947.2
9633	1926.6	3853.2	9692	1938.4	3876.8	9751	1950.2	3900.4	9810	1962	3924	9869	1973.8	3947.6
9634	1926.8	3853.6	9693	1938.6	3877.2	9752	1950.4	3900.8	9811	1962.2	3924.4	9870	1974	3948
9635	1927	3854	9694	1938.8	3877.6	9753	1950.6	3901.2	9812	1962.4	3924.8	9871	1974.2	3948.4
9636	1927.2	3854.4	9695	1939	3878	9754	1950.8	3901.6	9813	1962.6	3925.2	9872	1974.4	3948.8
9637	1927.4	3854.8	9696	1939.2	3878.4	9755	1951	3902	9814	1962.8	3925.6	9873	1974.6	3949.2
9638	1927.6	3855.2	9697	1939.4	3878.8	9756	1951.2	3902.4	9815	1963	3926	9874	1974.8	3949.6
9639	1927.8	3855.6	9698	1939.6	3879.2	9757	1951.4	3902.8	9816	1963.2	3926.4	9875	1975	3950
9640	1928	3856	9699	1939.8	3879.6	9758	1951.6	3903.2	9817	1963.4	3926.8	9876	1975.2	3950.4
9641	1928.2	3856.4	9700	1940	3880	9759	1951.8	3903.6	9818	1963.6	3927.2	9877	1975.4	3950.8
9642	1928.4	3856.8	9701	1940.2	3880.4	9760	1952	3904	9819	1963.8	3927.6	9878	1975.6	3951.2
9643	1928.6	3857.2	9702	1940.4	3880.8	9761	1952.2	3904.4	9820	1964	3928	9879	1975.8	3951.6
9644	1928.8	3857.6	9703	1940.6	3881.2	9762	1952.4	3904.8	9821	1964.2	3928.4	9880	1976	3952
9645	1929	3858	9704	1940.8	3881.6	9763	1952.6	3905.2	9822	1964.4	3928.8	9881	1976.2	3952.4
9646	1929.2	3858.4	9705	1941	3882	9764	1952.8	3905.6	9823	1964.6	3929.2	9882	1976.4	3952.8
9647	1929.4	3858.8	9706	1941.2	3882.4	9765	1953	3906	9824	1964.8	3929.6	9883	1976.6	3953.2
9648	1929.6	3859.2	9707	1941.4	3882.8	9766	1953.2	3906.4	9825	1965	3930	9884	1976.8	3953.6
9649	1929.8	3859.6	9708	1941.6	3883.2	9767	1953.4	3906.8	9826	1965.2	3930.4	9885	1977	3954
9650	1930	3860	9709	1941.8	3883.6	9768	1953.6	3907.2	9827	1965.4	3930.8	9886	1977.2	3954.4
9651	1930.2	3860.4	9710	1942	3884	9769	1953.8	3907.6	9828	1965.6	3931.2	9887	1977.4	3954.8
9652	1930.4	3860.8	9711	1942.2	3884.4	9770	1954	3908	9829	1965.8	3931.6	9888	1977.6	3955.2
9653	1930.6	3861.2	9712	1942.4	3884.8	9771	1954.2	3908.4	9830	1966	3932			
9654	1930.8	3861.6	9713	1942.6	3885.2	9772	1954.4	3908.8	9831	1966.2	3932.4			
9655	1931	3862	9714	1942.8	3885.6	9773	1954.6	3909.2	9832	1966.4	3932.8			
9656	1931.2	3862.4	9715	1943	3886	9774	1954.8	3909.6	9833	1966.6	3933.2			
9657	1931.4	3862.8	9716	1943.2	3886.4	9775	1955	3910	9834	1966.8	3933.6			
9658	1931.6	3863.2	9717	1943.4	3886.8	9776	1955.2	3910.4	9835	1967	3934			
9659	1931.8	3863.6	9718	1943.6	3887.2	9777	1955.4	3910.8	9836	1967.2	3934.4			
9660	1932	3864	9719	1943.8	3887.6	9778	1955.6	3911.2	9837	1967.4	3934.8			
9661	1932.2	3864.4	9720	1944	3888	9779	1955.8	3911.6	9838	1967.6	3935.2			
9662	1932.4	3864.8	9721	1944.2	3888.4	9780	1956	3912	9839	1967.8	3935.6			
9663	1932.6	3865.2	9722	1944.4	3888.8	9781	1956.2	3912.4	9840	1968	3936			
9664	1932.8	3865.6	9723	1944.6	3889.2	9782	1956.4	3912.8	9841	1968.2	3936.4			
9665	1933	3866	9724	1944.8	3889.6	9783	1956.6	3913.2	9842	1968.4	3936.8			
9666	1933.2	3866.4	9725	1945	3890	9784	1956.8	3913.6	9843	1968.6	3937.2			
9667	1933.4	3866.8	9726	1945.2	3890.4	9785	1957	3914	9844	1968.8	3937.6			
9668	1933.6	3867.2	9727	1945.4	3890.8	9786	1957.2	3914.4	9845	1969	3938			
9669	1933.8	3867.6	9728	1945.6	3891.2	9787	1957.4	3914.8	9846	1969.2	3938.4			
9670	1934	3868	9729	1945.8	3891.6	9788	1957.6	3915.2	9847	1969.4	3938.8			

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WCDMA VIII (900) frequencies

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2712	882,4	3529,6	2937	927,4	3709,6
2713	882,6	3530,4	2938	927,6	3710,4
2714	882,8	3531,2	2939	927,8	3711,2
2715	883	3532	2940	928	3712
2716	883,2	3532,8	2941	928,2	3712,8
2717	883,4	3533,6	2942	928,4	3713,6
2718	883,6	3534,4	2943	928,6	3714,4
2719	883,8	3535,2	2944	928,8	3715,2
2720	884	3536	2945	929	3716
2721	884,2	3536,8	2946	929,2	3716,8
2722	884,4	3537,6	2947	929,4	3717,6
2723	884,6	3538,4	2948	929,6	3718,4
2724	884,8	3539,2	2949	929,8	3719,2
2725	885	3540	2950	930	3720
2726	885,2	3540,8	2951	930,2	3720,8
2727	885,4	3541,6	2952	930,4	3721,6
2728	885,6	3542,4	2953	930,6	3722,4
2729	885,8	3543,2	2954	930,8	3723,2
2730	886	3544	2955	931	3724
2731	886,2	3544,8	2956	931,2	3724,8
2732	886,4	3545,6	2957	931,4	3725,6
2733	886,6	3546,4	2958	931,6	3726,4
2734	886,8	3547,2	2959	931,8	3727,2
2735	887	3548	2960	932	3728
2736	887,2	3548,8	2961	932,2	3728,8
2737	887,4	3549,6	2962	932,4	3729,6
2738	887,6	3550,4	2963	932,6	3730,4
2739	887,8	3551,2	2964	932,8	3731,2
2740	888	3552	2965	933	3732
2741	888,2	3552,8	2966	933,2	3732,8
2742	888,4	3553,6	2967	933,4	3733,6
2743	888,6	3554,4	2968	933,6	3734,4
2744	888,8	3555,2	2969	933,8	3735,2

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Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2745	889	3556	2970	934	3736
2746	889,2	3556,8	2971	934,2	3736,8
2747	889,4	3557,6	2972	934,4	3737,6
2748	889,6	3558,4	2973	934,6	3738,4
2749	889,8	3559,2	2974	934,8	3739,2
2750	890	3560	2975	935	3740
2751	890,2	3560,8	2976	935,2	3740,8
2752	890,4	3561,6	2977	935,4	3741,6
2753	890,6	3562,4	2978	935,6	3742,4
2754	890,8	3563,2	2979	935,8	3743,2
2755	891	3564	2980	936	3744
2756	891,2	3564,8	2981	936,2	3744,8
2757	891,4	3565,6	2982	936,4	3745,6
2758	891,6	3566,4	2983	936,6	3746,4
2759	891,8	3567,2	2984	936,8	3747,2
2760	892	3568	2985	937	3748
2761	892,2	3568,8	2986	937,2	3748,8
2762	892,4	3569,6	2987	937,4	3749,6
2763	892,6	3570,4	2988	937,6	3750,4
2764	892,8	3571,2	2989	937,8	3751,2
2765	893	3572	2990	938	3752
2766	893,2	3572,8	2991	938,2	3752,8
2767	893,4	3573,6	2992	938,4	3753,6
2768	893,6	3574,4	2993	938,6	3754,4
2769	893,8	3575,2	2994	938,8	3755,2
2770	894	3576	2995	939	3756
2771	894,2	3576,8	2996	939,2	3756,8
2772	894,4	3577,6	2997	939,4	3757,6
2773	894,6	3578,4	2998	939,6	3758,4
2774	894,8	3579,2	2999	939,8	3759,2
2775	895	3580	3000	940	3760
2776	895,2	3580,8	3001	940,2	3760,8
2777	895,4	3581,6	3002	940,4	3761,6
2778	895,6	3582,4	3003	940,6	3762,4
2779	895,8	3583,2	3004	940,8	3763,2

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Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2780	896	3584	3005	941	3764
2781	896,2	3584,8	3006	941,2	3764,8
2782	896,4	3585,6	3007	941,4	3765,6
2783	896,6	3586,4	3008	941,6	3766,4
2784	896,8	3587,2	3009	941,8	3767,2
2785	897	3588	3010	942	3768
2786	897,2	3588,8	3011	942,2	3768,8
2787	897,4	3589,6	3012	942,4	3769,6
2788	897,6	3590,4	3013	942,6	3770,4
2789	897,8	3591,2	3014	942,8	3771,2
2790	898	3592	3015	943	3772
2791	898,2	3592,8	3016	943,2	3772,8
2792	898,4	3593,6	3017	943,4	3773,6
2793	898,6	3594,4	3018	943,6	3774,4
2794	898,8	3595,2	3019	943,8	3775,2
2795	899	3596	3020	944	3776
2796	899,2	3596,8	3021	944,2	3776,8
2797	899,4	3597,6	3022	944,4	3777,6
2798	899,6	3598,4	3023	944,6	3778,4
2799	899,8	3599,2	3024	944,8	3779,2
2800	900	3600	3025	945	3780
2801	900,2	3600,8	3026	945,2	3780,8
2802	900,4	3601,6	3027	945,4	3781,6
2803	900,6	3602,4	3028	945,6	3782,4
2804	900,8	3603,2	3029	945,8	3783,2
2805	901	3604	3030	946	3784
2806	901,2	3604,8	3031	946,2	3784,8
2807	901,4	3605,6	3032	946,4	3785,6
2808	901,6	3606,4	3033	946,6	3786,4
2809	901,8	3607,2	3034	946,8	3787,2
2810	902	3608	3035	947	3788
2811	902,2	3608,8	3036	947,2	3788,8
2812	902,4	3609,6	3037	947,4	3789,6
2813	902,6	3610,4	3038	947,6	3790,4
2814	902,8	3611,2	3039	947,8	3791,2

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Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2815	903	3612	3040	948	3792
2816	903,2	3612,8	3041	948,2	3792,8
2817	903,4	3613,6	3042	948,4	3793,6
2818	903,6	3614,4	3043	948,6	3794,4
2819	903,8	3615,2	3044	948,8	3795,2
2820	904	3616	3045	949	3796
2821	904,2	3616,8	3046	949,2	3796,8
2822	904,4	3617,6	3047	949,4	3797,6
2823	904,6	3618,4	3048	949,6	3798,4
2824	904,8	3619,2	3049	949,8	3799,2
2825	905	3620	3050	950	3800
2826	905,2	3620,8	3051	950,2	3800,8
2827	905,4	3621,6	3052	950,4	3801,6
2828	905,6	3622,4	3053	950,6	3802,4
2829	905,8	3623,2	3054	950,8	3803,2
2830	906	3624	3055	951	3804
2831	906,2	3624,8	3056	951,2	3804,8
2832	906,4	3625,6	3057	951,4	3805,6
2833	906,6	3626,4	3058	951,6	3806,4
2834	906,8	3627,2	3059	951,8	3807,2
2835	907	3628	3060	952	3808
2836	907,2	3628,8	3061	952,2	3808,8
2837	907,4	3629,6	3062	952,4	3809,6
2838	907,6	3630,4	3063	952,6	3810,4
2839	907,8	3631,2	3064	952,8	3811,2
2840	908	3632	3065	953	3812
2841	908,2	3632,8	3066	953,2	3812,8
2842	908,4	3633,6	3067	953,4	3813,6
2843	908,6	3634,4	3068	953,6	3814,4
2844	908,8	3635,2	3069	953,8	3815,2
2845	909	3636	3070	954	3816
2846	909,2	3636,8	3071	954,2	3816,8
2847	909,4	3637,6	3072	954,4	3817,6
2848	909,6	3638,4	3073	954,6	3818,4
2849	909,8	3639,2	3074	954,8	3819,2

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Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2850	910	3640	3075	955	3820
2851	910,2	3640,8	3076	955,2	3820,8
2852	910,4	3641,6	3077	955,4	3821,6
2853	910,6	3642,4	3078	955,6	3822,4
2854	910,8	3643,2	3079	955,8	3823,2
2855	911	3644	3080	956	3824
2856	911,2	3644,8	3081	956,2	3824,8
2857	911,4	3645,6	3082	956,4	3825,6
2858	911,6	3646,4	3083	956,6	3826,4
2859	911,8	3647,2	3084	956,8	3827,2
2860	912	3648	3085	957	3828
2861	912,2	3648,8	3086	957,2	3828,8
2862	912,4	3649,6	3087	957,4	3829,6
2863	912,6	3650,4	3088	957,6	3830,4

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9 — Service information differences between RM-349 and RM-348

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General information

RM-349 Product data

The RM-349 (Nokia N79) is a 2G variant of RM-348 (Nokia N79-1). The key product data differences between the RM-349 (2G) and RM-348 (3G) are described below.

RM-349 is a GSM handportable phone, supporting GSM/ GPRS/ EGPRS 850/900/1800/1900. RM-349 does not support WLAN.

The device is a 2G and 2.5G networks Class A EGPRS DTM MSC 11 which means a maximum download speed of up to 296kbit/s with EGPRS, and up to 107kbit/s with GPRS.

According to GSM standard 05.05 it responds to class 4 (max. 2W) in GSM 850 and EGSM 900 class 1 (1W) in DCS 1800 and class 1 in PCS 1900. The device supports EGPRS (EDGE) class B as well as Bluetooth 2.0 EDR standard.

The device has two integrated cameras, one on the front and one on the back.

The device is an MMS (Multimedia Messaging Service) enabled multimedia computer with a large 2.4'' QVGA (240 x 320 pixels) TFT colour display capable of displaying 16 million colours and an integrated 5 Megapixel auto focus camera. The MMS implementation follows the OMA MMS standard release 1.2. The Browser is a highly advanced internet browser also capable of viewing operator domain XHTML Mobile Profile (MP) content.

The device uses Symbian 9.3 operating system and supports MIDP Java 2.0 & CLDC1.1, providing a good platform for compelling 3rd party applications.

Figure 73 View of RM-349

Connectivity

Operating bands	EGSM900/GSM850/1800/1900 MHz (no WCDMA / HSDPA)

Sales package

- Transceiver RM-349
- Nokia Battery (BL-6F)

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- Nokia Compact Travel Charger (AC-5)
- Music headset (HS-45/AD-45; HS-45/AD-43; HS-45/AD-54)
- Nokia Connectivity Cable (CA-101) (micro USB)
- CD-ROM
- User Guide
- Sales carton
- Warranty card

Main RF characteristics for GSM850/900/1800/1900 (quadband) and EDGE phones

Table 20 Main RF characteristics

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900 and EDGE
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
Output power	GSM850: +5 ... +33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
EDGE output power	EDGE850: +5 ... +27dBm/3.2mW ... 500mW
	EDGE900: +5 ... +27dBm/3.2mW ... 500mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 194
	GSM1800: 374
	GSM1900: 299
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16

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Parameter	Unit
Number of EDGE Tx power levels	GSM850 EDGE: 12
	GSM900 EDGE: 12
	GSM1800 EDGE: 14
	GSM1900 EDGE: 14

BB troubleshooting

Introduction to Bluetooth/FM radio troubleshooting

Bluetooth/GPS antenna

Figure 74 Bluetooth and GPS antenna in B-cover

The BT RF signal is routed from BTFMRDS2.0 to the BT antenna in the phone's B-cover. The GPS signal is routed from the GPS antenna into the GPS chip.

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Bluetooth/FM radio component layout and test points

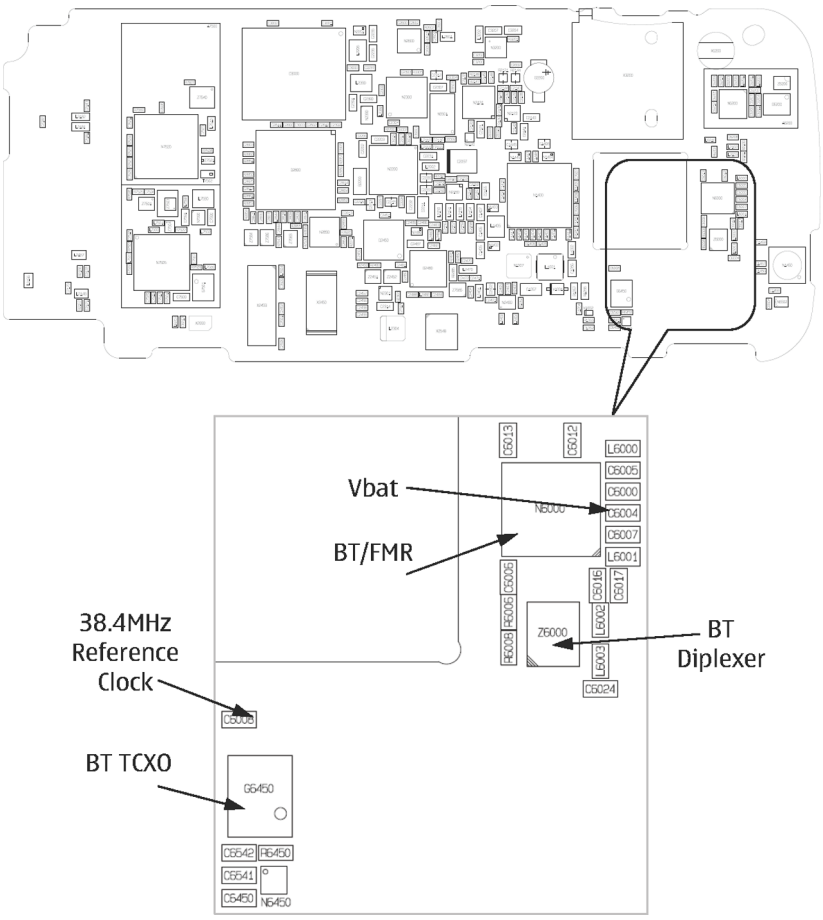

Figure 75 Bluetooth/FM Radio component layout and test points

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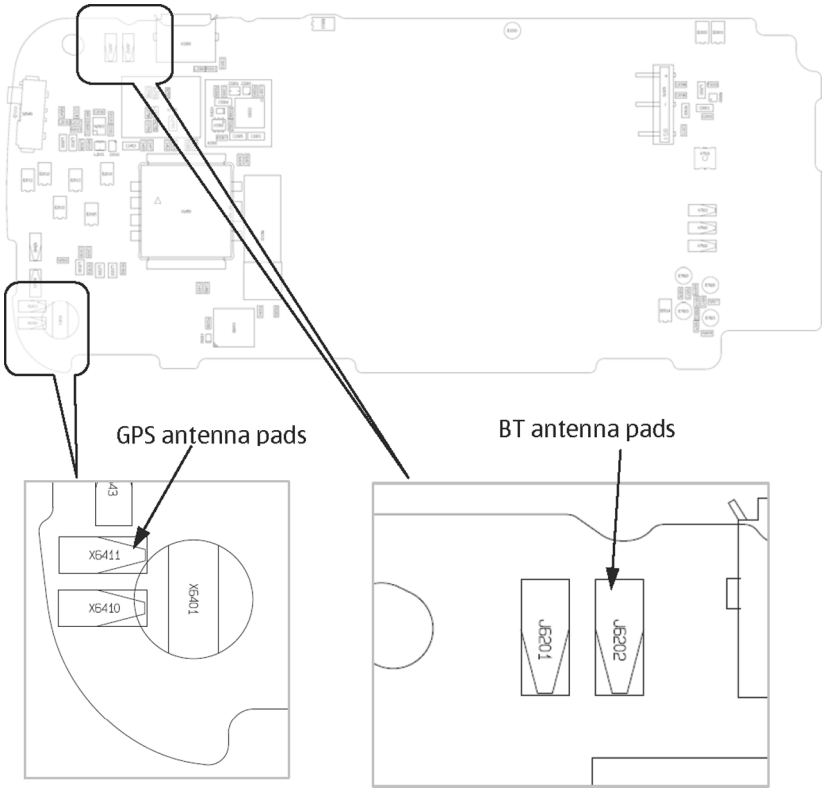

Figure 76 BT and GPS antenna pads

The Bluetooth antenna is product specific (antenna integrated into the phone's B cover). The Bluetooth RF signal is routed through the Bluetooth antenna. The FM RF signal is routed through a product specific FM antenna matching circuit to the phone headset connector. The FM radio audio signal is routed to the headset connector through the BB ASIC shared by the phone audio functions.

GPS layout and basic test points

The GPS components are located under the shield can A6200. Satellite signals are picked up by the phone's GPS antenna in the B-cover. The signal is then routed through a filter before being processed by the GPS5350 receiver ASIC.

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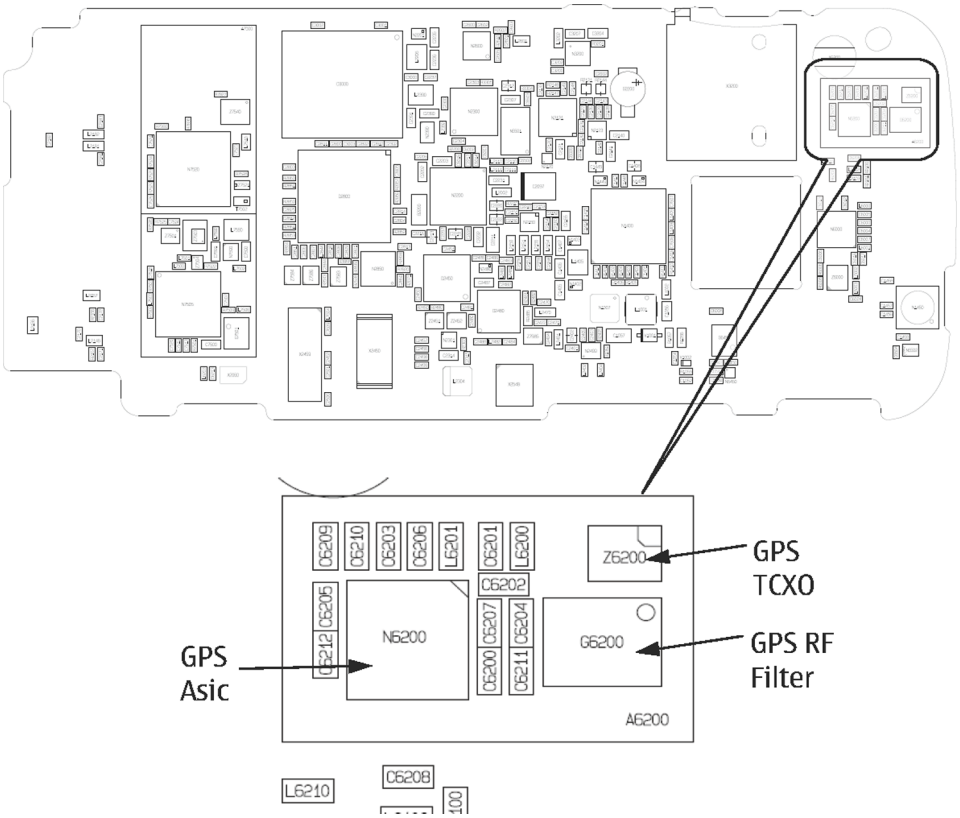

Figure 77 GPS layout and basic test points

RF troubleshooting

RM-349 RF block

As RM-349 is a 2G variant of the RM-348, there are no WCDMA RF components in the RF block of the RM-349. Therefore, the following WCDMA RF components are not assembled in RM-349:

- N7540 WCDMA PA
- N7541 WCDMA PA DC/DC conv.
- Z7541 WCDMA2100 Duplexer
- Z7582 WCDMA900/2100 TX filter
- Z7580 WCDMA2100 RX filter
- T7580 WCDMA2100 RX Balun

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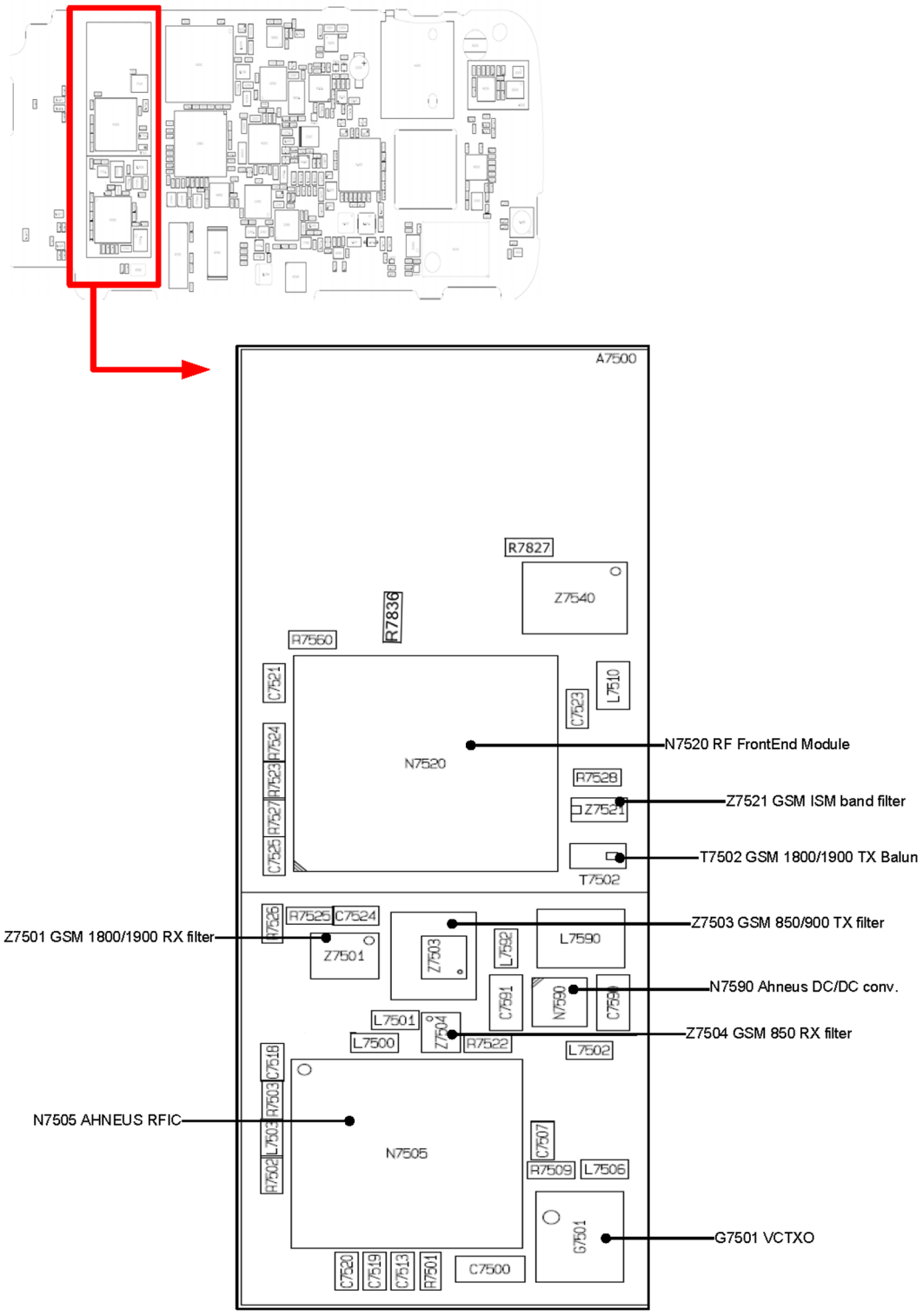

Figure 78 RM-349 RF key components

System module

Phone description

RAPIDO_2G is the main digital baseband ASIC in the HW53. It contains functionality for GSM EDGE.

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AVILMA is power management ASIC having voltage regulators and audio tranceiver and BETTY is energy management ASIC having charging switch and FBUS transceiver.

Memory components are internal COMBO 1 Gb + 2Gb M3 and a card reader for MicroSD.

Function	Description	Item ref
EM ASIC	AVILMA	N2200
	BETTY	N2300
System ASIC	RAPIDO_2G	D2800
Memory	COMBO 1Gb DDR+ 2Gb M3	D3000
Camera accelerator	OMAP-DM500	N1400
Display controller	S1D13747	D2450
Back-up battery	RTC back-up battery 311	G2200
FM-radio with RDS	BTHFMRDS2.0 discrete	N6000
Bluetooth	BTHFMRDS2.0 discrete	N6000
GPS	GPS5350	N6200
RF ASIC	Ahneus	N7505
GSM PA	TX FEM	N7520
Oscillator	VCTCXO 38.4 MHz	G7501
	Crystal 32.768 kHz	B2200
IO-expander	Basic IO-expander	N2850
SIM card reader		X2700
HS USB tranceiver	ISP15Q4A1	D3300
FM Transmitter	Si4713	N2600

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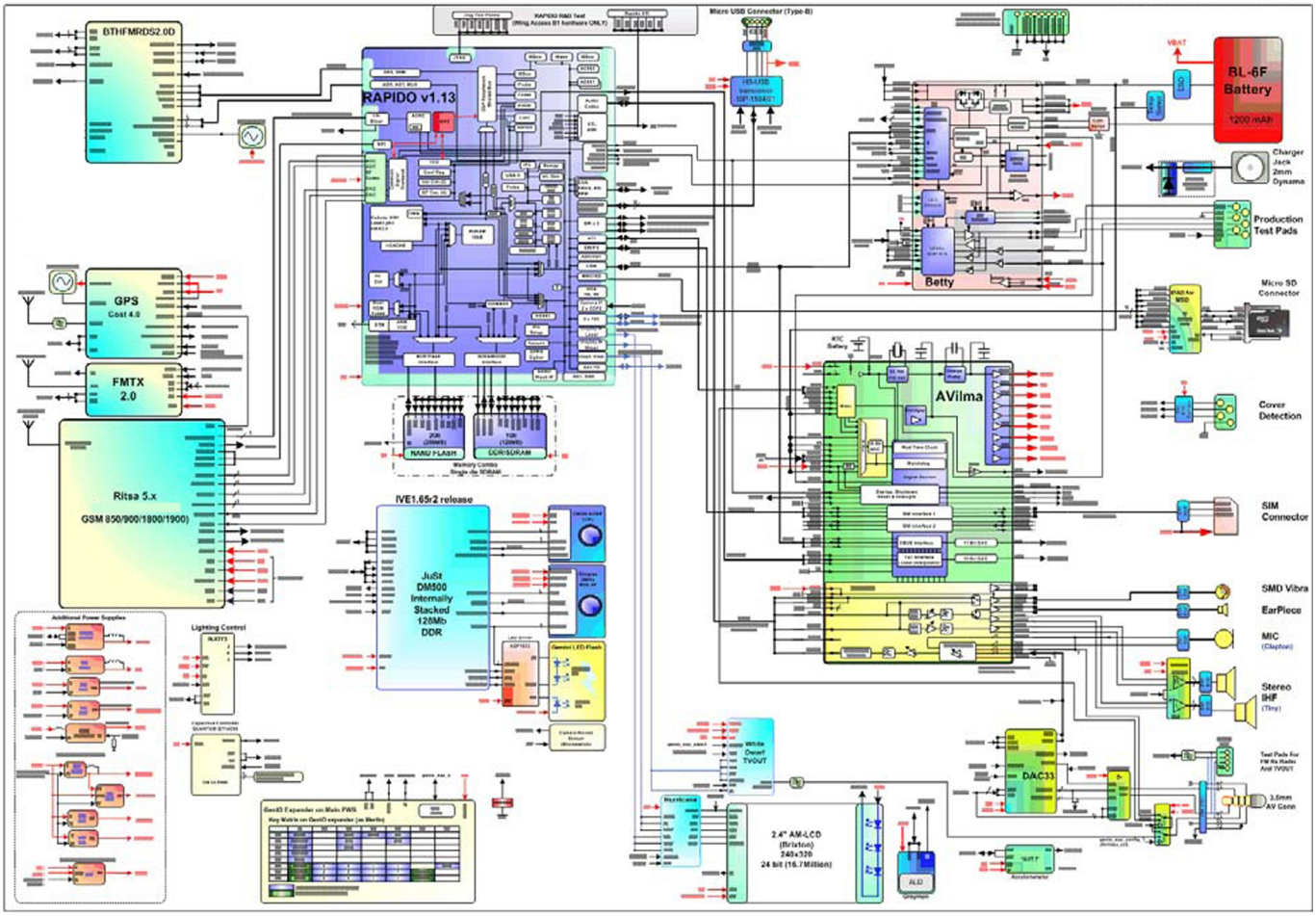
System module block diagram



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Power distribution

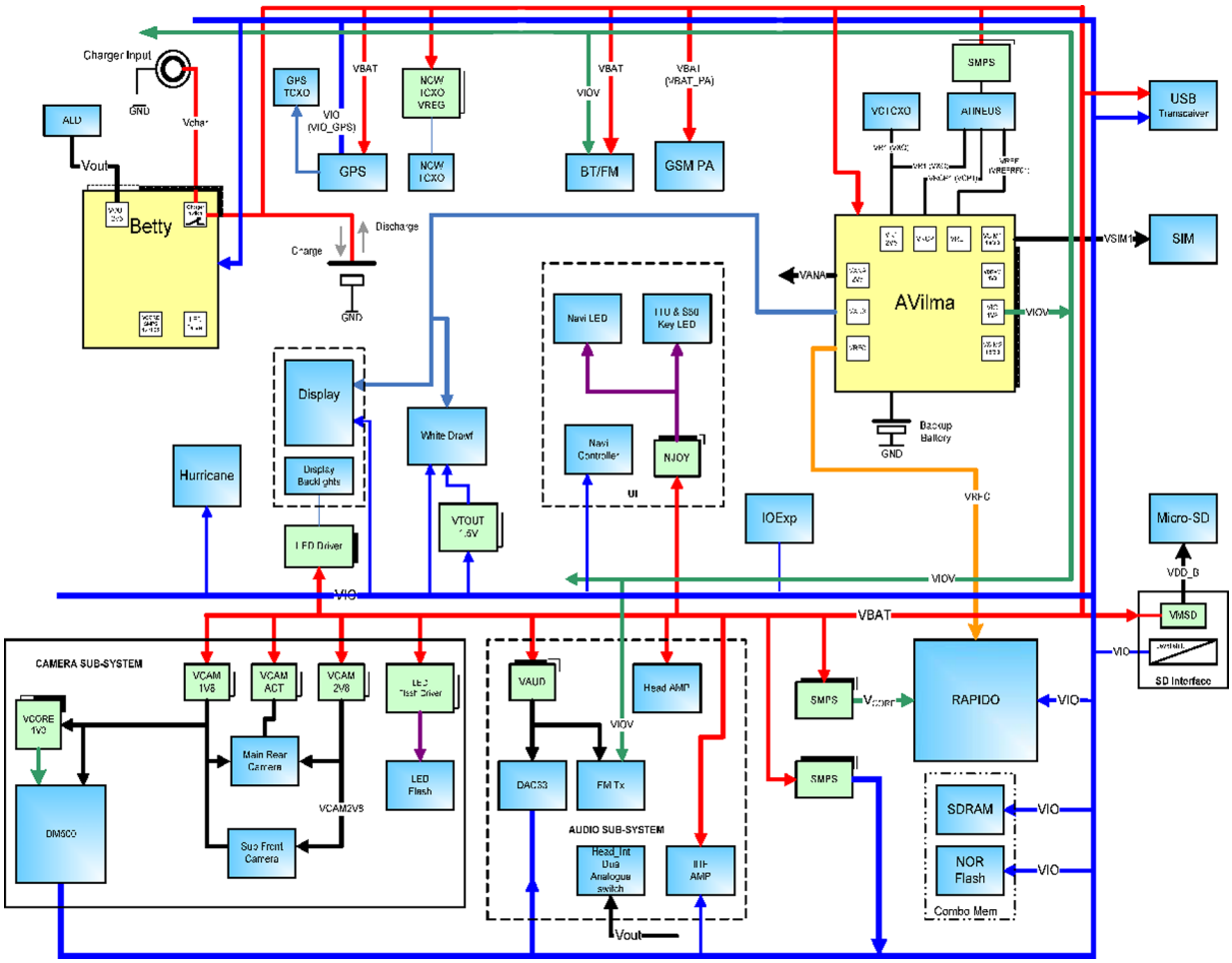

Figure 79 Power distribution

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Clocking scheme

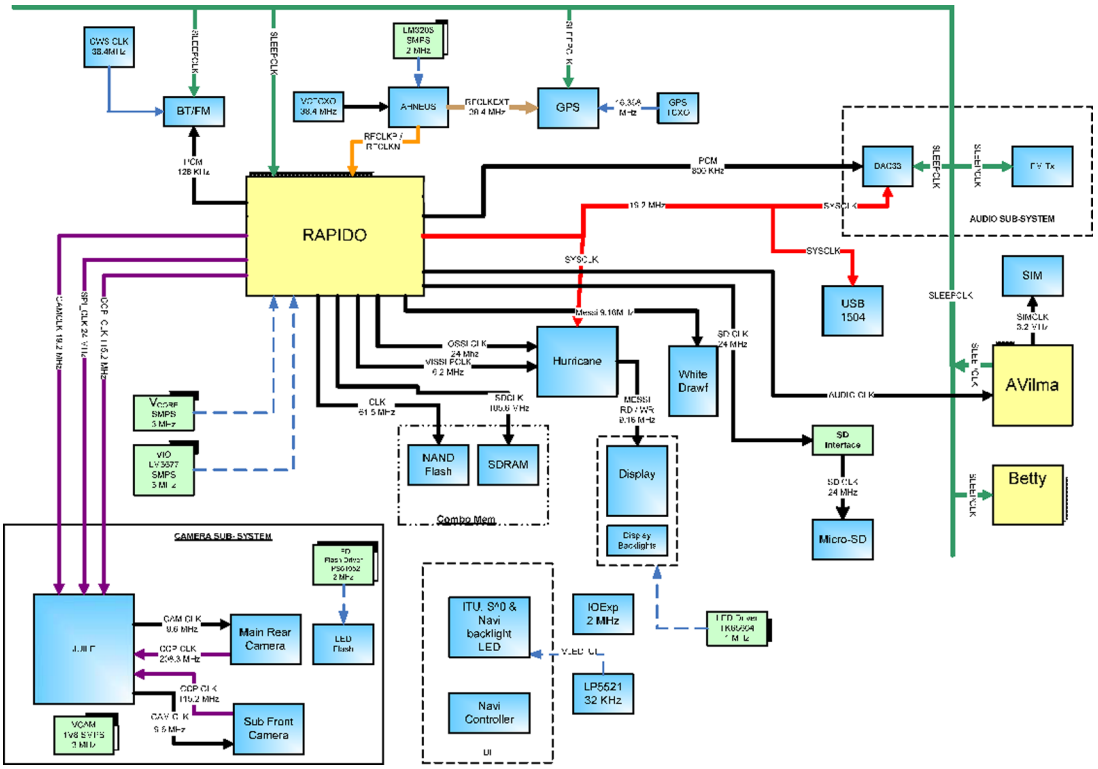

Figure 80 Clocking scheme

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10 — Service information differences between RM-350 and RM-348

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General information

RM-350 Product data

The RM-350 (Nokia N79-3) is a NAM/LTA variant of RM-348 (Nokia N79-1). The key product data differences between the RM-350 and RM-348 are described below.

RM-350 is a WCDMA/GSM dual mode handportable phone, supporting GSM/ GPRS/ EGPRS 850/900/1800/1900, with WCDMA850/1900 HSDPA and WLAN.

The device is a 3GPP Release 5 terminal supporting WCDMA/HSDPA, EGPRS and GPRS data bearers. For WCDMA HSDPA the maximum bit rate is up to 3.6 Mbps for downlink and 384 kbps for uplink with simultaneous CS speech or CS video (max. 64 kbps).

For 2G and 2.5G networks the device is a Class A EGPRS DTM MSC 11 which means a maximum download speed of up to 296kbit/s with EGPRS, and up to 107kbit/s with GPRS.

According to GSM standard 05.05 it responds to class 4 (max. 2W) in GSM 850 and EGSM 900 class 1 (1W) in DCS 1800 and class 1 in PCS 1900. The device supports EGPRS (EDGE) class B as well as Bluetooth 2.0 EDR standard.

The device supports two way video calls with two integrated cameras, one on the front and one on the back.

The device is an MMS (Multimedia Messaging Service) enabled multimedia computer with a large 2.4'' QVGA (240 x 320 pixels) TFT colour display capable of displaying 16 million colours and an integrated 5 Megapixel auto focus camera. The MMS implementation follows the OMA MMS standard release 1.2. The Browser is a highly advanced internet browser also capable of viewing operator domain XHTML Mobile Profile (MP) content.

The device uses Symbian 9.3 operating system and supports MIDP Java 2.0 & CLDC1.1, providing a good platform for compelling 3rd party applications.

Figure 81 View of RM-350

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Connectivity

Operating bands	WCDMA850/1900 (HSDPA) / EGSM900/ GSM850/1800/1900 MHz (EGPRS)

Sales package

- Transceiver RM-350
- Nokia Battery (BL-6F)
- Nokia Compact Travel Charger (AC-5)
- Music headset (HS-45/AD-45; HS-45/AD-43; HS-45/AD-54)
- Nokia Connectivity Cable (CA-101) (micro USB)
- CD-ROM
- User Guide
- Sales carton
- Warranty card

Main RF characteristics for GSM850/900/1800/1900 and WCDMA 850 and WCDMA 1900 phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA V (850) and WCDMA II (1900)
Rx frequency band	GSM850: 869 - 894MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA 850: 869 - 894 MHz
	WCDMA 1900: 1930 - 1990 MHz
Tx frequency band	GSM850: 824 - 849MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA 850: 824 - 849 MHz
	WCDMA 1900: 1850 - 1910 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA 850: -50 ... +24 dBm/0.01µW ... 251mW
	WCDMA 1900: -50 ... +24 dBm/0.01µW ... 251mW

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Parameter	Unit
EDGE output power	EDGE850: +5 ... +27dBm/3.2mW ... 500mW
	EDGE900: +5 ... +27dBm/3.2mW ... 500mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA 850: 108
	WCDMA 1900: 289
Channel spacing	GSM: 200 kHz (WCDMA 1900 100/200 kHz)
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA 850: 75
	WCDMA 1900: 75

RF troubleshooting

RM-350 RF block

As RM-350 is a NAM/LTA variant of RM-348, it has a slightly different RF block due to the support for WCDMA bands V (850) and II (1900). In terms of component reference numbers, the RF blocks of RM-350 and RM-348 are identical.

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Frequency mappings

WCDMA V (850) frequencies

WCDMA 850 Band V Channel Frequencies (MHz)								
Channel	Rx Frequency	Rx VCO	Channel	Rx Frequency	Rx VCO	Channel	Rx Frequency	Rx VCO
4357	871.4	1742.8	4391	878.2	1756.4	4425	885.0	1770.0
4358	871.6	1743.2	4392	878.4	1756.8	4426	885.2	1770.4
4359	871.8	1743.6	4393	878.6	1757.2	4427	885.4	1770.8
4360	872.0	1744.0	4394	878.8	1757.6	4428	885.6	1771.2
4361	872.2	1744.4	4395	879.0	1758.0	4429	885.8	1771.6
4362	872.4	1744.8	4396	879.2	1758.4	4430	886.0	1772.0
4363	872.6	1745.2	4397	879.4	1758.8	4431	886.2	1772.4
4364	872.8	1745.6	4398	879.6	1759.2	4432	886.4	1772.8
4365	873.0	1746.0	4399	879.8	1759.6	4433	886.6	1773.2
4366	873.2	1746.4	4400	880.0	1760.0	4434	886.8	1773.6
4367	873.4	1746.8	4401	880.2	1760.4	4435	887.0	1774.0
4368	873.6	1747.2	4402	880.4	1760.8	4436	887.2	1774.4
4369	873.8	1747.6	4403	880.6	1761.2	4437	887.4	1774.8
4370	874.0	1748.0	4404	880.8	1761.6	4438	887.6	1775.2
4371	874.2	1748.4	4405	881.0	1762.0	4439	887.8	1775.6
4372	874.4	1748.8	4406	881.2	1762.4	4440	888.0	1776.0
4373	874.6	1749.2	4407	881.4	1762.8	4441	888.2	1776.4
4374	874.8	1749.6	4408	881.6	1763.2	4442	888.4	1776.8
4375	875.0	1750.0	4409	881.8	1763.6	4443	888.6	1777.2
4376	875.2	1750.4	4410	882.0	1764.0	4444	888.8	1777.6
4377	875.4	1750.8	4411	882.2	1764.4	4445	889.0	1778.0
4378	875.6	1751.2	4412	882.4	1764.8	4446	889.2	1778.4
4379	875.8	1751.6	4413	882.6	1765.2	4447	889.4	1778.8
4380	876.0	1752.0	4414	882.8	1765.6	4448	889.6	1779.2
4381	876.2	1752.4	4415	883.0	1766.0	4449	889.8	1779.6
4382	876.4	1752.8	4416	883.2	1766.4	4450	890.0	1780.0
4383	876.6	1753.2	4417	883.4	1766.8	4451	890.2	1780.4
4384	876.8	1753.6	4418	883.6	1767.2	4452	890.4	1780.8
4385	877.0	1754.0	4419	883.8	1767.6	4453	890.6	1781.2
4386	877.2	1754.4	4420	884.0	1768.0	4454	890.8	1781.6
4387	877.4	1754.8	4421	884.2	1768.4	4455	891.0	1782.0
4388	877.6	1755.2	4422	884.4	1768.8	4456	891.2	1782.4
4389	877.8	1755.6	4423	884.6	1769.2	4457	891.4	1782.8
4390	878.0	1756.0	4424	884.8	1769.6	4458	891.6	1783.2

WCDMA 850 Band V UARFCN Channel Frequencies (MHz)								
Channel	Rx Frequency	Rx VCO	Channel	Rx Frequency	Rx VCO	Channel	Rx Frequency	Rx VCO
1007	871.5	3486.0	1032	876.5	3506.0	1062	882.5	3530.0
1012	872.5	3490.0	1037	877.5	3510.0	1087	887.5	3550.0

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WCDMA II (1900) frequencies

WCDMA 1900 Band II Channel Frequencies (MHz)

Channel	Rx Frequency	Rx VCO	Channel	Rx Frequency	Rx VCO	Channel	Rx Frequency	Rx VCO	Channel	Rx Frequency	Rx VCO
9662	1932.4	3864.8	9732	1946.4	3892.8	9802	1960.4	3920.8	9871	1974.2	3948.4
9663	1932.6	3865.2	9733	1946.6	3893.2	9803	1960.6	3921.2	9872	1974.4	3948.8
9664	1932.8	3865.6	9734	1946.8	3893.6	9804	1960.8	3921.6	9873	1974.6	3949.2
9665	1933.0	3866.0	9735	1947.0	3894.0	9805	1961.0	3922.0	9874	1974.8	3949.6
9666	1933.2	3866.4	9736	1947.2	3894.4	9806	1961.2	3922.4	9875	1975.0	3950.0
9667	1933.4	3866.8	9737	1947.4	3894.8	9807	1961.4	3922.8	9876	1975.2	3950.4
9668	1933.6	3867.2	9738	1947.6	3895.2	9808	1961.6	3923.2	9877	1975.4	3950.8
9669	1933.8	3867.6	9739	1947.8	3895.6	9809	1961.8	3923.6	9878	1975.6	3951.2
9670	1934.0	3868.0	9740	1948.0	3896.0	9810	1962.0	3924.0	9879	1975.8	3951.6
9671	1934.2	3868.4	9741	1948.2	3896.4	9811	1962.2	3924.4	9880	1976.0	3952.0
9672	1934.4	3868.8	9742	1948.4	3896.8	9812	1962.4	3924.8	9881	1976.2	3952.4
9673	1934.6	3869.2	9743	1948.6	3897.2	9813	1962.6	3925.2	9882	1976.4	3952.8
9674	1934.8	3869.6	9744	1948.8	3897.6	9814	1962.8	3925.6	9883	1976.6	3953.2
9675	1935.0	3870.0	9745	1949.0	3898.0	9815	1963.0	3926.0	9884	1976.8	3953.6
9676	1935.2	3870.4	9746	1949.2	3898.4	9816	1963.2	3926.4	9885	1977.0	3954.0
9677	1935.4	3870.8	9747	1949.4	3898.8	9817	1963.4	3926.8	9886	1977.2	3954.4
9678	1935.6	3871.2	9748	1949.6	3899.2	9818	1963.6	3927.2	9887	1977.4	3954.8
9679	1935.8	3871.6	9749	1949.8	3899.6	9819	1963.8	3927.6	9888	1977.6	3955.2
9680	1936.0	3872.0	9750	1950.0	3900.0	9820	1964.0	3928.0	9889	1977.8	3955.6
9681	1936.2	3872.4	9751	1950.2	3900.4	9821	1964.2	3928.4	9890	1978.0	3956.0
9682	1936.4	3872.8	9752	1950.4	3900.8	9822	1964.4	3928.8	9891	1978.2	3956.4
9683	1936.6	3873.2	9753	1950.6	3901.2	9823	1964.6	3929.2	9892	1978.4	3956.8
9684	1936.8	3873.6	9754	1950.8	3901.6	9824	1964.8	3929.6	9893	1978.6	3957.2
9685	1937.0	3874.0	9755	1951.0	3902.0	9825	1965.0	3930.0	9894	1978.8	3957.6
9686	1937.2	3874.4	9756	1951.2	3902.4	9826	1965.2	3930.4	9895	1979.0	3958.0
9687	1937.4	3874.8	9757	1951.4	3902.8	9827	1965.4	3930.8	9896	1979.2	3958.4
9688	1937.6	3875.2	9758	1951.6	3903.2	9828	1965.6	3931.2	9897	1979.4	3958.8
9689	1937.8	3875.6	9759	1951.8	3903.6	9829	1965.8	3931.6	9898	1979.6	3959.2
9690	1938.0	3876.0	9760	1952.0	3904.0	9830	1966.0	3932.0	9899	1979.8	3959.6
9691	1938.2	3876.4	9761	1952.2	3904.4	9831	1966.2	3932.4	9900	1980.0	3960.0
9692	1938.4	3876.8	9762	1952.4	3904.8	9832	1966.4	3932.8	9901	1980.2	3960.4
9693	1938.6	3877.2	9763	1952.6	3905.2	9833	1966.6	3933.2	9902	1980.4	3960.8
9694	1938.8	3877.6	9764	1952.8	3905.6	9834	1966.8	3933.6	9903	1980.6	3961.2
9695	1939.0	3878.0	9765	1953.0	3906.0	9835	1967.0	3934.0	9904	1980.8	3961.6
9696	1939.2	3878.4	9766	1953.2	3906.4	9836	1967.2	3934.4	9905	1981.0	3962.0
9697	1939.4	3878.8	9767	1953.4	3906.8	9837	1967.4	3934.8	9906	1981.2	3962.4
9698	1939.6	3879.2	9768	1953.6	3907.2	9838	1967.6	3935.2	9907	1981.4	3962.8
9699	1939.8	3879.6	9769	1953.8	3907.6	9839	1967.8	3935.6	9908	1981.6	3963.2
9700	1940.0	3880.0	9770	1954.0	3908.0	9840	1968.0	3936.0	9909	1981.8	3963.6
9701	1940.2	3880.4	9771	1954.2	3908.4	9841	1968.2	3936.4	9910	1982.0	3964.0
9702	1940.4	3880.8	9772	1954.4	3908.8	9842	1968.4	3936.8	9911	1982.2	3964.4
9703	1940.6	3881.2	9773	1954.6	3909.2	9843	1968.6	3937.2	9912	1982.4	3964.8
9704	1940.8	3881.6	9774	1954.8	3909.6	9844	1968.8	3937.6	9913	1982.6	3965.2
9705	1941.0	3882.0	9775	1955.0	3910.0	9845	1969.0	3938.0	9914	1982.8	3965.6
9706	1941.2	3882.4	9776	1955.2	3910.4	9846	1969.2	3938.4	9915	1983.0	3966.0
9707	1941.4	3882.8	9777	1955.4	3910.8	9847	1969.4	3938.8	9916	1983.2	3966.4
9708	1941.6	3883.2	9778	1955.6	3911.2	9848	1969.6	3939.2	9917	1983.4	3966.8
9709	1941.8	3883.6	9779	1955.8	3911.6	9849	1969.8	3939.6	9918	1983.6	3967.2
9710	1942.0	3884.0	9780	1956.0	3912.0	9850	1970.0	3940.0	9919	1983.8	3967.6
9711	1942.2	3884.4	9781	1956.2	3912.4	9851	1970.2	3940.4	9920	1984.0	3968.0
9712	1942.4	3884.8	9782	1956.4	3912.8	9852	1970.4	3940.8	9921	1984.2	3968.4
9713	1942.6	3885.2	9783	1956.6	3913.2	9853	1970.6	3941.2	9922	1984.4	3968.8
9714	1942.8	3885.6	9784	1956.8	3913.6	9854	1970.8	3941.6	9923	1984.6	3969.2
9715	1943.0	3886.0	9785	1957.0	3914.0	9855	1971.0	3942.0	9924	1984.8	3969.6
9716	1943.2	3886.4	9786	1957.2	3914.4	9856	1971.2	3942.4	9925	1985.0	3970.0
9717	1943.4	3886.8	9787	1957.4	3914.8	9857	1971.4	3942.8	9926	1985.2	3970.4
9718	1943.6	3887.2	9788	1957.6	3915.2	9858	1971.6	3943.2	9927	1985.4	3970.8
9719	1943.8	3887.6	9789	1957.8	3915.6	9859	1971.8	3943.6	9928	1985.6	3971.2
9720	1944.0	3888.0	9790	1958.0	3916.0	9860	1972.0	3944.0	9929	1985.8	3971.6
9721	1944.2	3888.4	9791	1958.2	3916.4	9861	1972.2	3944.4	9930	1986.0	3972.0
9722	1944.4	3888.8	9792	1958.4	3916.8	9862	1972.4	3944.8	9931	1986.2	3972.4
9723	1944.6	3889.2	9793	1958.6	3917.2	9863	1972.6	3945.2	9932	1986.4	3972.8
9724	1944.8	3889.6	9794	1958.8	3917.6	9864	1972.8	3945.6	9933	1986.6	3973.2
9725	1945.0	3890.0	9795	1959.0	3918.0	9865	1973.0	3946.0	9934	1986.8	3973.6
9726	1945.2	3890.4	9796	1959.2	3918.4	9866	1973.2	3946.4	9935	1987.0	3974.0
9727	1945.4	3890.8	9797	1959.4	3918.8	9867	1973.4	3946.8	9936	1987.2	3974.4
9728	1945.6	3891.2	9798	1959.6	3919.2	9868	1973.6	3947.2	9937	1987.4	3974.8
9729	1945.8	3891.6	9799	1959.8	3919.6	9869	1973.8	3947.6	9938	1987.6	3975.2
9730	1946.0	3892.0	9800	1960.0	3920.0	9870	1974.0	3948.0			
9731	1946.2	3892.4	9801	1960.2	3920.4	9871	1974.2	3948.4			

WCDMA 1900 Band II UARFCN Channel Frequencies (MHz)

Channel	Rx Frequency	Rx VCO	Channel	Rx Frequency	Rx VCO	Channel	Rx Frequency	Rx VCO	Channel	Rx Frequency	Rx VCO
412	1932.5	3865.0	487	1947.5	3895.0	562	1962.5	3925.0	637	1977.5	3955.0
437	1937.5	3875.0	512	1952.5	3905.0	587	1967.5	3935.0	662	1982.5	3965.0
462	1942.5	3885.0	537	1957.5	3915.0	612	1972.5	3945.0	687	1987.5	3975.0

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Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

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DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared

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IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency

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RF PopPort™	Reduced function PopPort™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator

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VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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